MANUAL OF PRESCRIBIN

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A TEXT-BOOK OF MATERIA MEDICA

For Students of Medicine.

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OF MEDICINE

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C. R. MARSHALL, M.D.

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OF MEDICINE

BY

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PREFACE

It has been said that the Art of Prescribing is a lost art. To some extent this saying is true; and the cause may be found in the development of Pharmacology and Pathology during the past fifty years, whereby all the time allotted to Materia Medica is now required for teaching the actions and uses of drugs and other remedial agents. The advantages and disadvantages of particular modes and forms of application, the difficulties of combining drugs, and other kindred difficulties connected with Prescribing, have consequently suffered comparative neglect. It is the aim of this little book to supply such information, its main object being to relate the principles which underlie the Art of Prescribing, while it also seeks to describe most of the methods and forms of application which may be used.

The book has been written from the standpoint of a practitioner of medicine, and is therefore not a treatise on the Art of Dispensing. For the use of junior students, however, a chapter on dispensing is given, on lines similar to the short course on this subject in the University of St. Andrews; and, for more advanced students, a chapter on Examples

of Incompatibility, with notes on the prescriptions employed.

The prescriptions given as examples in other parts of the work are merely intended to illustrate statements made in the text. They are, for the most part, limited to those drugs or their preparations which are common to the British and the United States Pharmacopœias.

Latin words and phrases used in prescribing are given in the Appendices. Students who are unfamiliar with the Latin names of drugs and their preparations, and the names of medicinal forms, are recommended to consult Appendix I. An English-Latin Vocabulary, which forms Appendix II., is added for reference.

The book is largely the result of investigations and observations made in my own laboratory, and I gratefully acknowledge the help I have received from Dr. J. H. Wigner and Miss Margaret A. B. Wright, M.A., in the prosecution of the work.

C. R. M.

University College, Dundee.

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A MANUAL OF PRESCRIBIN

INTRODUCTION

The aim of the medical curriculum is to [illegible] student with sufficient knowledge to enable [illegible] treat disease rationally. For this purpose he [illegible] not only know the pathological conditions he w[illegible] to combat and the action of the remedies he [illegible] to use, but he must also be able to administer [illegible] ever to the best advantage and to order the[illegible] the manner approved by custom. The last is [illegible] by means of a prescription.

A Prescription

This, in its complete form, is a written [illegible] (or formulæ) of remedies, with directions for [illegible] preparation and administration, used by a [illegible] practitioner in the treatment of disease. Wh[illegible] may be the purpose to which it is to be [illegible] generally consists of the following parts:

Name of patient (sometimes placed at the [illegible]

Superscription, consisting of the word [illegible] [illegible].

Inscription, containing the remedies to be [illegible]

A MANUAL OF PRESCRIBING

INTRODUCTION

The aim of the medical curriculum is to equip a student with sufficient knowledge to enable him to treat disease rationally. For this purpose he must not only know the pathological conditions he wishes to combat and the action of the remedies he intends to use, but he must also be able to administer the latter to the best advantage and to order them in the manner approved by custom. The last is done by means of a prescription.

A Prescription

This, in its complete form, is a written formula (or formulæ) of remedies, with directions for its preparation and administration, used by a medical practitioner in the treatment of disease. Whatever may be the purpose to which it is to be put, it generally consists of the following parts :

Name of patient (sometimes placed at the foot).
Superscription, consisting of the word *recipe* or *mitte*.
Inscription, containing the remedies to be used.

Subscription, or directions to the dispenser.
Signature, the directions for the administration of the medicine.
The *date* and *name of the prescriber*.

The superscription, inscription, and subscription are written in Latin, usually abbreviated; the remainder of the prescription in the language of the country.

In former times the whole of the prescription, with the exception of the names of the patient and the prescriber, was written in Latin, but nowadays the directions for the administration of the medicine are also written in the vulgar tongue. This has many advantages and few disadvantages. The patient or nurse must know these directions sooner or later, and no valid reason has been advanced why they should not be read on the prescription as well as on the box or bottle. Moreover, it is sometimes difficult to write complicated descriptions in good Latin, and when written dispensers have failed to translate them correctly. Serious mistakes, even fatal results, have followed from this cause.

The case for the employment of Latin in the remainder of the prescription is different. It is not generally advisable to let a patient know what he is taking, nor does it concern him to know what are the directions to the dispenser. Moreover, Latin, being the language of scientific terminology, is more precise and is used for the names of drugs and their preparations in all civilised countries, consequently there is little difficulty in getting a prescription obtained in one country dispensed in another.[1] Lastly, Latin admits of intelligible abbreviation, a point of importance to a busy practitioner.

[1] As the Pharmacopœias of different countries vary, not only with regard to the drugs they contain, but sometimes also as regards the strength of preparations having similar names, it is necessary that the Pharmacopœia of the country in which the prescription was given should be employed in dispensing. Fortunately, there is some prospect of international agreement regarding the strength of the preparations

The most important part of a prescription is the **inscription**—the part containing the remedies to be used. It may consist of one or more ingredients. If we know of one drug or preparation that will do all that we require it to do, without producing any undesirable effects, it contains but one. Thus calomel, phenacetin, and many other substances are frequently ordered as powders without any addition; and many of the official preparations, such as the pills, powders, lotions, plasters, and mixtures, are commonly ordered alone. In some cases the prescription consists only of an active ingredient and a diluent or solvent, but most frequently prescriptions contain more than one active ingredient or preparation.

Reasons for combining drugs.—Apart from ingredients which are used to give the requisite form to medicines, such as solvents, diluents, and excipients generally, drugs may be said to be combined in prescriptions for the following reasons:

i. To obtain the conjoint effect of two or more active substances;

ii. To diminish or annul undesirable effects produced by one or more active ingredients;

iii. To increase the solubility or aid the dissemination of active substances;

iv. Occasionally to produce a new compound.

Frequently an ingredient plays more than one part, but it is essential for the sake of clearness to consider these divisions independently.

---

of potent drugs. If there is any probability of a prescription being dispensed in a foreign country, it is advisable to write it throughout in Latin.

i. When two or more active remedies are employed in the same formula they are usually intended to serve one purpose —the alleviation of some symptom or the abolition of some pathological condition. They may act upon the same organ in similar or in different ways, or they may act chiefly on different organs. Thus chloral hydrate and potassium bromide depress the same organ—the cerebrum—and are frequently prescribed together for insomnia. In Mistura Sennæ Composita B.P. (and Infusum Sennæ Compositum U.S.P.) we have an example of a purgative preparation acting in two ways on the intestine, the senna causing irritation of the intestinal mucous membrane, and the magnesium sulphate acting mainly in a physical manner. And as an example of a combination acting upon different organs may be mentioned the employment of a cardiac tonic and a diuretic acting upon the kidneys in the treatment of cardiac dropsy. The advantages gained by such combinations do not come within the scope of this work. It is only necessary to emphasise the importance of treating with one formula one thing at a time and prescribing combinations of drugs with that object in view. The attempt to treat a variety of independent conditions with one prescription is not only unscientific but will generally end in comparative failure.

ii. Unfortunately, many active drugs produce, along with their valuable actions, certain undesired effects which it is necessary to counteract. These may be a bitter or nauseous taste, an irritant action, or certain special effects. The means of combating them are in most cases pharmacological, and are appropriately described in text-books of pharmacology and therapeutics. Thus morphine depresses the respiratory centre, and is frequently conjoined with a small dose of atropine to counteract this, and purgatives which cause griping are invariably prescribed with a carminative. In so far as ill effects can be annulled or diminished by the manner of prescribing they will be incidentally alluded to in the following pages.

iii. The question of solubility is dealt with later (page 59) and a few examples only need be mentioned here. The solubility of caffeine or theobromine is markedly increased by the

addition of sodium salicylate or sodium benzoate, quinine by the presence of phenazone or slight excess of mineral acid, mercuric chloride by sodium chloride, and salicylic acid by the presence of most alkaline salts. In nearly all, if not all, of these and similar cases the increased solubility is due to a chemical change, which in most instances, however, is of little importance from a therapeutic point of view.

iv. Although drugs are comparatively rarely combined with the intention of producing a new compound, a few striking examples require mention. The most noteworthy is the Pilula Ferri B.P. (Massa Ferri Carbonatis U.S.P.), during the preparation of which ferrous carbonate is produced by the interaction of ferrous sulphate and sodium carbonate. Chlorine, or rather a mixture of chlorine and chlorine peroxide in solution, is obtained by prescribing potassium chlorate and strong hydrochloric acid as a mixture (see page 284). And a so-called decolorised solution of iodine, which is probably a solution of ammonium iodide and iodate, is prepared by adding ammonia solution to an alcoholic solution of iodine. Sodium salicylate is sometimes ordered by prescribing salicylic acid and sodium bicarbonate in order to get a slightly aërated solution, which is pleasanter to take; and acetate of iron is commonly prescribed by means of perchloride of iron and ammonium acetate solutions.

The classic form of the inscription.—This form was evolved by Dr. Paris from older and more complex types. It is a form which is not rigidly adhered to, but it is well to keep in mind its various parts. These are—basis, adjuvans, corrigens, et excipiens. The **basis** is the chief ingredient of the medicine; the **adjuvans**, or aiding agent, aids or completes the action of the basis; the **corrigens** is intended to counteract any ill-effects produced by the adjuvans or basis; the **excipiens** is the diluent, and gives the form to the medicine. An example is given on page 7.

The **superscription** consists of the single word *recipe* or *mitte*, which governs the inscription.

The **subscription** contains the directions to the dispenser for the compounding of the inscription, and frequently consists of the simple words *misce*, *fiat mistura*, *fiat pilula*, etc. It is frequently conjoined to the signature if this is being written in Latin.

Formerly sufficient directions were given for the dispensing of the inscription, but this is rarely done now in English-speaking countries. It is very rarely necessary. Qualified dispensers are quite competent to deal with any prescription likely to be written, and it is only when two equally correct methods of dispensing a prescription give different results (as in the case mentioned on page 284), or when some departure from a usual custom is desired, that any such directions need be added.

An example of a prescription.—The example will be of the so-called classic type of inscription. We will assume that we are treating an early case of acute bronchial catarrh. In this condition potassium carbonate, or an organic salt of an alkali metal—*e.g.*, potassium citrate—which acts in a somewhat similar manner, is often useful in relieving the turgescence of the blood-vessels and increasing and rendering more fluid the bronchial secretion. As it tends to act on the diseased tissue we may regard it as the basis. It will not, however, give immediate relief to the cough and soreness of the chest which are present, and it is necessary to relieve these, as the act of coughing tends to maintain the pathological condition; hence we add a little morphine in the form of a liquor. To cover the taste of these

medicines we may add a syrup, and as a diluent we may employ distilled water, or, if we wish to aid the basis or corrigens, an aromatic water or infusion. The prescription, after filling in the quantities of the medicines, might then read:

Mr. John Smith.

Superscriptio		Recipe	
Inscriptio	*basis*	Potassii Citratis	drachmas quatuor
	adjuvans	Liquoris Morphinæ Hydrochloridi	drachmas tres
	corrigens	Syrupi Aurantii	unciam cum semisse
	excipiens	Aquam	ad uncias sex
Subscriptio		Fiat mistura.	Signetur:
Signatura		'One tablespoonful to be taken every three hours.	

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In many prescriptions the basis, adjuvans, and corrigens are intimately associated. In the Mistura Sennæ Composita B.P., for example, the magnesium sulphate is the basis, the senna in the infusion which forms the excipient is the adjuvans, and the remaining three ingredients are mainly corrigentes. Such modifications are common; indeed, the chief interest in the classic type of inscription is in its educational value. The only rule that can be laid down regarding the inscription is that each ingredient shall play a recognised part and be compatible with all the other ingredients.

The **use of 'ad'** in a prescription should be clearly understood. It is employed when it is

desired to make up a medicine to a given quantity or weight, and is almost solely used in prescribing medicines in the liquid form. If reference be made to the prescription above, it will be seen that without 'ad' the quantity of medicine ordered is nearly eight ounces. As the prescriber intended the patient to get twenty grains of potassium citrate and fifteen minims of solution of morphine hydrochloride in each dose, to have dispensed eight ounces instead of six would have been an error. Moreover, the stock sizes of bottles[1] preclude odd quantities being neatly dispensed. It is a rule, therefore, that when any substance which will materially add to the bulk of the liquid occurs in the prescription, a sufficiency only of the excipient is added to make up the medicine to a definite amount. This is indicated by 'ad.' In practice the word is rarely used except when the excipient is preceded by a liquid preparation or by relatively large amounts of salts containing considerable quantities of water of crystallisation.

Prescriptions for one dose.—Prescriptions are frequently written for one dose. In this case it is necessary to add to the subscription the number of doses to be sent, but it is unnecessary to state the dose in the signature, although this is frequently done for safety, since only an inscription for one dose has been written. The previous pre-

[1] $\frac{1}{4}$ oz., $\frac{1}{2}$ oz., 1 oz., $1\frac{1}{2}$ oz., 2 oz., 3 oz., 4 oz., 6 oz., 8 oz., 10 oz., 12 oz., 16 oz., 20 oz., 24 oz.
5 Cc., 10 Cc., 20 Cc., 30 Cc., 40 Cc., 50 Cc., 100 Cc., 150 Cc., 200 Cc., 250 Cc., 300 Cc., 400 Cc., 500 Cc.

scription might therefore have been written as follows :

Recipe
Potassii Citratis grana viginti
Liquoris Morphinæ Hydrochloridi minima quindecim
Syrupi Aurantii drachmam
Aquam ad unciam dimidiam (vel semunciam
Fiat mistura. Mitte tales doses numero xij. (vel mitte uncias sex).
Signetur : 'To be taken every three hours.'

Prescribing by the centesimal system.—This system has not yet become legalised in the British Empire, but it is employed in prescriptions in the United States and most other civilised countries. It presents no difficulties provided that the doses of drugs and their preparations have been learned in this system ; but for purposes of prescribing it does not possess any decided advantages over the older method. In German-speaking countries both solids and liquids are weighed, and therefore are prescribed in grammes. In the United States and France the more convenient method of weighing the solids and measuring the liquids is in vogue. By this method the prescription given on page 7 would be written somewhat as follows :

Recipe

Potassii Citratis	18·0 Gm.
Morphinæ Hydrochloridi . .	0·12 Gm.
Syrupi Aurantii	60·0 Cc.
Aquam	ad 200·0 Cc.

Fiat mistura.

S gnetur : 'One tablespoonful to be taken every three hours.'

When a simple solution or other dilution of a single drug is required the following method of prescribing it is sometimes used in nearly all countries :

Mitte
  Solutionis Argenti Nitratis 2 : 100 . unciam
Sig. 'To be applied night and morning.'

or

M. Solutio. Chloral. Hydrat. 10 per cent., uncias quatuor
Sig. 'Two teaspoonfuls to be taken at bedtime.'

Abbreviations. — Abbreviation of the Latin words of a prescription is almost universal. In practice the prescription on page 7 would be written thus (the meaning of the symbols for quantities is given on page 15) :

℞
Pot. Cit.		ʒiv
Liq. Morph. Hyd.		ʒiij
Syr. Aurant.		℥iss
Aq.	ad	℥vj

Ft. mist. Sig. ℥ss. tert. qq. hor. sum.

Contraction of words, however, should never be carried to the point of ambiguity. It is necessary to lay special stress upon this point, as it is frequently overlooked. Pot. Sulph., Ext. Col., Acid. Hydroc. Dil., are not permissible. The first might mean potassii sulphatis, potassii sulphitis, or potassæ sulphuratæ ; the second, extracti colchici or extracti colocynthidis ; the last, acidi hydrochlorici diluti or acidi hydrocyanici diluti ; and serious results might ensue from the substitution of the more poisonous of these substances where

the less poisonous was intended. The dispenser, it is true, ought to be able to correct these mistakes, but it is wrong and impolitic to expect him to do so. There should be no ambiguity whatever in any prescription.

Unusual doses.—Where the ordinary maximal dose of a drug is notably exceeded, it is advisable for the prescriber to indicate his intention and knowledge of this by writing out the dose in words and underlining them, after indicating it in the usual way.

℞

Tinct. Belladon.	℥j <u>(unciam)</u>
Glycerini	℥iss
Aq. Chlorof.	ad ℥iv

Ft. mist.

Sig. 'Two teaspoonfuls to be taken every six hours.'

Other methods in use are merely underlining the dose, placing a [!] after it, or writing 'correct,' or some other equivalent, at the foot of the prescription.

Relations of physician and dispenser.—These should be of a cordial character. The dispenser is an expert in the compounding of drugs, and consequently any criticism or advice that he may offer regarding methods of combination should be carefully considered. It should also not be forgotten that he shares with the physician the responsibility for the medicine supplied, and that it is his duty to draw the physician's attention to any mistake that he thinks might have serious consequences.

But while the dispenser's criticism should be accepted with gratitude, no liberty should be allowed him to alter or modify a compatible prescription. Even the addition or

abstraction of apparently innocuous ingredients with the intention of improving the prescription should not be permitted. The addition of sulphuric acid to a mixture containing quinine sulphate or a viscous substance to one containing a bismuth salt are cases in point. Such additions must not be expected and should not be made. If, however, by force of circumstances, a dispenser is called on to dispense an incompatible prescription and is unable to consult the prescriber, no blame can be attached to him for making what modifications he deems necessary for the safety of the patient and his own reputation. Such changes he is expected to notify on the prescription.

The Latin Construction of a Prescription

This follows the rules of accidence and syntax. As the student is presumably familiar with these, it is only necessary to draw attention to a few important points.[1] By referring to the prescription

[1] Students may be reminded that—

(i.) The verb must agree with its nominative in number and person; the adjective (or participle or pronoun used adjectively) with its noun in gender, number, and case; and the relative pronoun with its antecedent in gender, number, and person.

(ii.) 'Time when' is put in the ablative, duration of time and measure of space in the accusative case.

(iii.) A substantive governed by another substantive is in the genitive case.

(iv.) *Sum*, *fio*, and a few other verbs take the same case after them as before them.

(v.) *Utor* and a few other deponent verbs, and the substantives *opus* and *usus*, require the ablative after them.

(vi.) If *quam* is not used, the comparative of adjectives is followed by the ablative case.

(vii.) The subject of a verb in the infinitive mood is in the accusative case.

(viii.) Certain prepositions govern the accusative or ablative case, or both; and certain verbs, adverbs, and adjectives govern the genitive, and certain verbs and adjectives the dative case.

already given (page 7) it will be noticed that in the inscription the quantities of the ingredients are in the accusative case, being governed by 'recipe'; the names of the ingredients are in the genitive, being governed by a substantive (accusative of quantity). This rule is invariable as regards the quantities, and is almost invariable as regards the names of the ingredients. The commonest exception is the excipient followed by 'ad,' but yolk of egg—rendered by 'vitellus'—and a few other similar instances occur. A mental reference to the prescription as it should read when translated will avoid any pitfalls of this nature. Thus in the case of the yolk of an egg the English version would read 'Take the yolk of one egg,' which would naturally be written 'Recipe, ovi unius vitellum' A similar procedure will overcome the difficulties of the excipient with 'ad.' The last line of the prescription (page 7) reads 'Take water up to six ounces,' hence water is put in the accusative case Care should be taken, however, when using a medicated excipient to distinguish between adjectives and nouns in the name of a preparation (see page 309); Aquam Chloroformam (for Aquam Chloroformi), Infusum Scoparium (for Infusum Scoparii), Aquam Destillatæ (for Aquam Destillatam) are not permissible. If 'ad' is unnecessary to the prescription—*i.e.*, if six ounces of water is required—the excipient must be put into the genitive case as any other ingredient.

Previous to the latter half of the last century, the excipient, whether followed by 'ad' or not, was invariably put in the genitive case. 'Tantum quantum sufficit' was regarded as

being understood, the phrase reading 'take of water as much as is sufficient' to make the quantity indicated. The genitive case is still largely used, and is accepted as correct.

The subscription and the Latin form of the signature, if adopted, rarely offer any difficulties. Attention, however, may be drawn to the different ways of writing such simple directions as 'One tablespoonful to be taken three times a day':

1. Signetur: Cochleare magnum [1] ter in die sumendum.
2. Signetur: Semuncia [2] ter in die sumenda.
3. Capiat cochleare magnum ter in die.
4. Capiat [3] semunciam ter in die.

In the last two examples signetur (let it be labelled) or signa (label thou) does not occur, as the directions given 'Let the patient (*æger* or *ægra* understood) take a tablespoonful, etc.,' are not those which the dispenser is expected to put upon the label. In the first two examples the gerundive of the verb is used. The use of this is very common in prescription-writing, and as it is in a sense a participle it must agree with the noun in gender, number, and case.

The ablative absolute is often employed when reference is made in the directions to the condition of the patient—*e.g.*, Cochleare minimum, urgenti flatu, ex aqua sumendum (a teaspoonful to be taken in water when the flatulence is

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[1] Or amplum or largum—*i.e.*, a great or large spoonful (see page 18).

[2] Or uncia dimidia (*cf.* half, page 337). A tablespoonful is regarded as equivalent to half an ounce.

[3] Or sumat. Capiatur semuncia is also correct—*i.e.*, let a tablespoonful be taken, etc. Capio and sumo are used indiscriminately, but most commonly in the forms given above.

troublesome), or whenever an interpolation unnecessary to the construction of the sentence is desired—*e.g.*, Haustus, phiala prius agitata, hora somni sumendus (the draught to be taken at bedtime, the bottle having been previously shaken).

Weights and Measures

The weights and measures used in the British Pharmacopœia are the Imperial weights and measures legal for commercial purposes in the British Empire. In the Pharmacopœia of the United States the metric system is employed. But in both countries the apothecaries' weights are still mainly used for the purpose of prescribing.

The continued use of the apothecaries' system is due to the facts that the grains of the apothecaries' and Imperial systems and the American commercial grain are the same, and that the apothecaries' symbols, which are universally employed, have been allowed to retain their original meaning.

Although the grain is the same in the three systems, the ounce and the higher values are different. These, however, with the exception of the ounce, are rarely employed in prescribing. It is perhaps necessary to state that the apothecaries' ounce has no legal status; it is only employed as an expression of the symbol ℥. The difference between the symbols of the apothecaries' and the statutory ounce should be carefully noted.

Weights.—	*Latin Name*	*Abbreviation or Sign*
Grain	granum, i.	gr.
Scruple (20 grains)	scrupulus, i.	℈
Drachm (60 grains)	drachma, æ.	ʒ
Ounce,[1] apothecaries' (480 grains)	uncia, æ.	℥
,, avoirdupois ($437\frac{1}{2}$ grains)		oz.
Pound, apothecaries' (12 apoth. ounces)	libra, æ.	℔
,, avoirdupois (16 avoir. ounces)		lb.

[1] The American commercial ounce weighs 455·7 grains.

Measures. —

	Latin Name	*Abbreviation or Sign*
Minim	minimum, i.	♏
Fluid drachm (60 minims) . .	fluidrachma, æ.	fl. ʒ
Fluid ounce[1] (8 fl. drachms) . .	fluiduncia, æ.	fl. ℥
Pint, Imperial (20 fl. ounces) . .	octarius, ii.	O
Gallon (8 pints)	congius, ii.	C

The fl. in the abbreviations of ounce and drachm is usually omitted.

The weight of a minim is 0·9114 grain at 62° F. (16·7° C.).

An Imperial fluid ounce is the volume of one avoirdupois ounce of water at 62° F. The minim, therefore, weighs $\frac{437 \cdot 5}{480}$ grain = 0·9114 grain.[2]

In using the apothecaries' symbols it is customary to employ roman characters after the symbols to denote quantities—*e.g.*, gr. x ; ʒiss ; ℥iv ; except for fractions other than half, when arabic numerals are employed—*e.g.*, gr. $\frac{1}{60}$.

Metric weights and measures. — In ordinary prescribing the gramme and milligramme only are used as weights, and the cubic centimeter as measure.

	Latin Name	*Abbreviation*
Gramme	gramma, atis (n.).	Gm.
Milligramme (0·001 Gm.) .	milligramma, atis (n.)	Mg.
Cubic centimeter . .	centimetrum cubicum	Cc.

[1] The apothecaries' fluid ounce is of larger volume than the Imperial fluid ounce. The apothecaries' (wine) pint contains 12 apothecaries' fluid ounces; and the wine gallon contains 8 such pints.

[2] The minim of the United States Pharmacopœia weighs $\frac{455 \cdot 7}{480}$ grain = 0·9483 grain at 22° C. Approximately, 48 American minims are equal to 50 Imperial minims. The American commercial pint is 16 fluid ounces.

The quantities are indicated by placing arabic numerals before the abbreviation, thus 15·0 Gm., 200·0 Cc. The gramme alone is commonly employed as the only unit of weight, and fractions are indicated as decimal parts of a gramme—*e.g.*, 0·004 Gm. It is safer, however, to follow Stokvis' suggestion and indicate fractions of a gramme in terms of a milligramme—*e.g.*, 4 Mg., 250 Mg. This prevents any mistake arising from the careless placing of the decimal point, an error which is liable (but which ought not) to occur in using the metric system in prescribing.

Relation of metric and imperial standards.—The following approximate relation is sufficiently accurate for medicinal purposes :

Weights.—		
1 ounce	= 28·35	grammes (nearly)
1 grain	= 0·065	gramme (nearly)
1 gramme	= 15·5	grains (nearly)
1 milligramme	= 0·015 ($\frac{1}{65}$)	grain (nearly)
Measures.—		
1 fluid ounce	= 28·5	Cc. (nearly)
1 fluid drachm	= 3·6	Cc. (nearly)
1 minim	= 0·06	Cc. (nearly)
1 cubic centimeter	= 17	minims (nearly)
1 litre	= $1\frac{3}{4}$	pints (rather more)

Domestic measures.—The quantity of medicine to be taken or used is always stated on the label in terms of domestic measures. Consequently the capacity of these must approximately be known.

The following table gives the capacity of the measures in common use :

—	Imperial Measure	Metric Measure	Latin Name
A teaspoonful .	1 fl. drachm	4 Cc.	Cochleare minimum [1]
A dessertspoonful	2 fl. drachms	8 Cc.	Cochleare medium [2]
A tablespoonful .	½ fl. oz.	16 Cc.	Cochleare magnum [3]
A wineglassful .	2½ fl. oz.	75 Cc.	Cyathus vinosus (vel vinarius)
A teacupful .	5 fl. oz.	150 Cc.	Theæ poculum
A breakfastcupful	8 fl. oz.	240 Cc.	Theæ poculum magnum
A tumblerful .	10 fl. oz.	300 Cc.	Cyathus magnus
A drop . .	—	—	Gutta, -æ

A drop of water is regarded as equivalent to one minim of water, but this is true only for certain specified conditions. The size of a drop varies considerably with the method of dropping employed, and it varies enormously with different liquids. Speaking broadly, drops of alcohol and ethereal liquids are a half to one-third the size of drops of water; drops of so-called viscous liquids do not differ very materially in size from those of drops of water. It is advisable, however, to avoid employing drops as measures in the inscription.

The weight of drops of different liquids is mainly dependent on the capillarity constant (not the viscosity) of the

[1] Cochleare infantis, cochleare parvum, and cochleare parvulum are also employed.

[2] Cochleare modicum is also used.

[3] Cochleare amplum and cochleare largum are also used.

liquid; the weight of drops of the same liquid is dependent on the rapidity of their formation, and, within somewhat narrow limits, is proportional to the diameter of the tube (if circular) from which they are dropped.

In practice, dropping from a bottle usually with the stopper partially inserted is commonly resorted to. The following protocol of experiments will give an idea of the size of drops which may be obtained in this manner. Th number represents drops in a fluid drachm (3·6 Cc.): Water, 46 (without stopper in bottle, 38); alcohol, 115; ether, 120; paraldehyde, 120; chloroform, 180; oil of turpentine, 100; spirit of camphor, 108; tincture of opium, 104; tincture of strophanthus, 107; creosote, 92; castor oil (without stopper), 68; glycerin (without stopper), 46.

MODES OF ADMINISTERING MEDICINES

Medicines may be administered by any of the accessible tissues or cavities of the body. They may be applied to produce a local effect or may be intended to be absorbed into the blood and produce a so-called general action. To some extent the predominance of one or other effect in many cases depends on the manner in which the drug is administered—*i.e.*, on the mode of prescribing it. Speaking generally, it is necessary, if a drug is to interact with the constituents of the cells of the body, that it should go into solution in the fluids which bathe those cells. As the cells are bathed in an aqueous medium, it follows that, theoretically, to obtain the most efficient action of an active drug it should be in aqueous solution or in a form capable of entering into aqueous solution. Any condition which tends to retard such solution (*e.g.*, administration in the form of pills or in fatty substances) or, when dissolved, the dissemination (*e.g.*, the presence of colloidal substances) of an active drug, tends also to delay and diminish its action, although it may prolong its effects.[1] If a non-volatile substance is

[1] It must not be assumed that the absorption and pharmacological action of different drugs are proportionate to their solubility in water. Solution, and diffusion and osmosis play an important part in absorption and pharmacological action, but only a part.

insoluble in aqueous media and *undergoes no chemical change* in contact with the fluids or tissues of the body, it can only act passively or indirectly; in other words, if applied to the surfaces or cavities of the body it can only exert a protective and an absorbent or emollient effect, and if injected into the circulation can only induce symptoms by a mechanical action. As such substances are employed as diluents and solvents, it will be necessary to note the influence they exert on the absorption of drugs.

If the active substance exists in a particulate form in the vehicle—*i.e.*, is merely mixed with it—the vehicle simply acts in a mechanical manner, hindering solution (assuming the active substance to be soluble) by preventing or retarding the access of the body fluids to the particles of the drug. If, however, the drug is in solution in the excipient (say an oil or a paraffin), another factor is introduced which tends to prevent the passage of the drug into an aqueous medium. In this case the distribution of the drug in the two media is regulated to a certain extent by the principle of partition coefficients, to which, in virtue of the use of oily and paraffin substances as vehicles, it is necessary to refer.

The principle of partition coefficients.—This states that if a substance is soluble in two media immiscible with each other, when dissolved in a mixture of the two solvents it will go into solution in each in the proportion in which it is soluble in them separately, provided that the dissolved substance has the same molecular weight in the two solvents.

Thus camphor, which is soluble in about 4 parts of olive oil and about 800 parts of water, will, if added to a mixture of olive oil and water, go into solution in each in the proportion of 200 and 1 respectively—*i.e.*, if equal parts of olive oil and water are taken, 200 times as much camphor will go into solution in the olive oil as in the water. Therefore if an oily solution of camphor is applied to mucous membranes, the camphor will gradually pass into the secretion covering the membrane and will continue to do so until equilibrium in the form of the relative solubilities in each solvent is reached. As, however, absorption of the camphor constantly goes on through the mucous surface, this equilibrium is not reached, consequently the camphor is gradually transferred from the oil to the mucous secretion and from thence to the lymph and blood. If the camphorated oil is taken into the stomach the same phenomenon occurs, but owing to the relatively large bulk of aqueous medium present the transference from oil to gastric contents is more rapid.

The principle explains in some degree the action of all forms of medicine consisting of an active substance dissolved in an excipient immiscible with the body fluids (some suppositories, ointments, emulsions, paraffin solutions, etc.), but it is strictly true only within wide limits, owing to drugs having different molecular weights in different solvents, and is no longer true when the excipient has been converted into a miscible product (*e.g.*, oils into soaps). With the possible exception of emulsions in the stomach, however, it is probable that drugs

dissolved in fats and oils are dissipated before saponification occurs.

The skin.—The most important factors affecting the action of drugs when applied to the skin are the sebaceous secretion of the skin and the horny layer of the epidermis. These combined effectually prevent the absorption of water through the skin and also of salts and many other substances dissolved in it. An aqueous basis is therefore not generally suitable if absorption of a remedy into or through the normal skin is required. Fatty and oily bases, on the other hand, mix readily with the sebaceous matter of the skin, and thus bring any medicament they may contain into direct contact with the epidermal cells. By the application of friction they may even be made to penetrate into the superficial layers of the epidermis. The action of substances so combined is thereby facilitated, but it is very doubtful if a non-volatile drug incapable of undergoing chemical change in contact with the tissues can be absorbed into the blood in this way (see page 24). Readily diffusible, for the most part volatile, substances, however, which have a solvent action on the sebaceous secretion (ether, chloroform, etc.), penetrate relatively quickly into the skin if their evaporation is sufficiently prevented, and are in part absorbed into the blood. They also cause absorption of substances dissolved in them, although, on account of the irritation they produce, they are not used alone for this purpose. But, even if applied in aqueous solution, these and other substances soluble in the sebaceous secretion penetrate into,

and may be absorbed through, the skin. Thus carbolic acid penetrates and may to some extent be absorbed in this way. Being more soluble in sebaceous matter than in water, it passes from the lotion into the sebaceous secretion of the skin, and, owing to its solubility in aqueous media, it passes to some extent from the sebaceous secretion into the lymph bathing the lower layers of the skin. On the other hand, non-volatile substances insoluble in the sebaceous secretion (*e.g.*, potassium iodide), however applied, are not absorbed by the normal skin to any appreciable degree. Cleansing the skin of sebaceous matter, however, permits the penetration of substances in aqueous solution, and even absorption can be obtained by the simultaneous use of electricity (cataphoresis).

The horny layer of the skin may be regarded as a dead membrane. It forms a protective covering to the skin, and enables the skin to withstand applications of drugs which would prove injurious to other tissues. Under ordinary circumstances it is impregnated with sebaceous matter, which prevents the penetration of aqueous solutions as such. But even after the fatty matter has been removed as far as possible it still offers great resistance to the penetration of such solutions. Continued application of water to the skin of the palms and soles, which is devoid of sebaceous glands, merely causes swelling of the outer layers, and no absorption of water into the blood through this channel has yet been proved. The horny layer also offers a similar, though less marked, resistance to fatty substances. Penetration of such substances is obtained mainly by

friction, and deep penetration is effected through the thinner layer of epidermis around the mouths of the sweat ducts, by the sebaceous and sweat glands themselves, and through slight excoriations produced by the friction. The greater the thickness of the horny layer, the more resistant is that portion of the skin to drugs. The application of substances having a solvent action on the horny layer, such as alkalies and acetic acid, facilitates the penetration of substances contained in them.

When the skin is *denuded of epidermis* the conditions advantageous to absorption are changed. So long as the excoriated part remains moist, they are similar to those affecting mucous membranes (see page 27). If, however, the excoriated part has been allowed to become dry the conditions in some respects approach those of the normal skin.

Remedies are applied to the skin with the intention of producing a local effect or of being absorbed into the blood and producing a *general action.* Those intended to be absorbed are generally applied mixed with an oily or fatty excipient. The most noteworthy example is mercurial ointment, which is rubbed well into the skin or, in the case of children, applied on a binder. The ointment so applied is forced into the sweat ducts by the friction, and the mercury, after being converted into a compound, is absorbed. The method is dirty, and repeated application to any one part produces irritation. Simple compounds of other heavy metals are not absorbed in the same way, partly owing to their different behaviour with albuminous solutions. Another type of drug which readily produces a

general action when applied to the skin is methyl salicylate. If simply applied to the skin it is rapidly absorbed, owing largely to its diffusibility and solubility in oily substances. As it produces marked irritation, it is advisable to apply it mixed with an equal or larger volume of oil, although in this form it is not much used to produce a general action.

The *advantages* of administering drugs by the skin over administration by the mouth are (i.) less frequent application and more prolonged effect, owing to the slower absorption ; (ii.) the avoidance of a local action on the digestive system. The *disadvantages* are (i.) less accurate dosage, although in most cases this can be sufficiently regulated for therapeutic purposes ; (ii.) a local irritant action on the skin may be produced ; (iii.) the method is less cleanly and entails greater inconvenience in its administration.

Remedies applied to the skin to produce a *local effect* may be required to act upon a disease of the skin or to affect some more deeply seated part. The latter effect is obtained by the application of blisters, baths, poultices, etc. Those applied to the skin with the view of affecting some local disease may be required to act superficially or deeply, and this influences to some extent the choice of the excipient (page 225). The forms of application used in the local treatment of skin diseases are lotions, liniments, ointments and their modifications (salve-muslins, sticks, pastes, etc.), plasters and their modifications (plaster-mulls, chartæ), powders, fumigations, poultices and fomentations, baths, varnishes

and collodions, jellies (gelatin, starch, etc.), and medicated tissues. They are described in detail later. It is only necessary to mention that absorption into the circulation may occur under favourable circumstances from such applications: the injudicious use of a belladonna plaster has frequently produced toxic symptoms.

Mucous membranes.—These differ from the skin in being infiltrated with a watery exudation and in having no protective coat corresponding to the horny layer of the skin. Aqueous solutions, therefore, mix with the surface secretion and penetrate into the membrane better than mixtures in fatty vehicles. The latter, indeed, cannot be said to penetrate at all, and are often quickly washed away. A portion of the medicament contained in them will, however, if soluble in aqueous media, enter into solution in the mucous secretion, and may thus reach the deeper parts of the mucous membrane, but if insoluble in the mucous secretion the action of both medicament and excipient must be superficial. In diseased conditions of exposed mucous membranes, however, the dryness and incrustations which are not infrequently present permit of fatty bases remaining in contact for some time, and, consequently, in such cases these excipients form one of the best means of exhibiting drugs.

Mucous membranes are much more susceptible to drugs than the normal skin. Even water produces pain when applied to the mucous membrane of the nose or to the conjunctiva. This is due to

the water acting as a hypotonic solution. Consequently in applying aqueous solutions to sensitive mucous membranes it is advisable that they should be in a condition as near isotonic with the secretion as possible. If this cannot be obtained by the drug or drugs alone, it can be effected by the addition of the proper amount of sodium chloride (*cf.* page 145). Fortunately, only an approximation to an isotonic solution is necessary, as the mucous membranes are practically insusceptible to changes in osmotic pressure within fairly wide limits.

With the exception of the mucous membrane of the stomach and intestines, which is used as a channel for the absorption of drugs, drugs are applied to mucous membranes almost solely for a local effect. They are administered in aqueous solution or suspension, or as powders, ointments, suppositories, pencils, etc., which often receive special names according to the manner of application and the part to which they are applied. In some cases special apparatus is necessary for their administration.

Affections of the *mouth and throat* may be treated with mouth washes and gargles, paints, lozenges, and powders; a fatty or paraffin vehicle is rarely advisable. Paints and powders are applied with a brush or on cotton-wool held in forceps or twisted on a probe; powerfully corrosive substances (*e.g.*, nitric acid) are applied with a glass rod. Powders are also administered with an insufflator. This consists of a small receptacle for the powder, a nozzle, and an arrangement (usually a valved rubber ball or a syringe) for driving the

powder through the nozzle. The receptacle is often barrel-shaped; to one end is attached the nozzle, which may be more or less curved, and to the other end the valved rubber ball. The powder is introduced through an opening in the barrel, which is closed by a plug or a small sliding door, and the powder is then discharged through the mouth of the nozzle by a blast of air caused by pressure on the rubber ball. A similar arrangement has been employed for applying the fumes of calomel. For the local application of powerful substances to the back of the mouth and pharynx a laryngoscopic or rhinoscopic mirror is sometimes necessary. Gargles when used in the ordinary way do not reach beyond the anterior pillars of the fauces, but a portion of the solution diluted by the buccal secretions is conveyed further back by diffusion and the act of swallowing. It is said that by performing the act of swallowing and returning the gargle before swallowing is completed, the tonsils can be affected. This trick cannot, however, be done by everyone.

The *nasal mucous membrane* may be treated by nasal douches, by the insufflation or sniffing of powders, by bougies, and by inhalations. Local applications may be made by means of pencils or tampons, and the anterior nares can be affected by ointments. Nasal douches are usually administered by means of a siphon, which consists of a rubber tube, to one end of which a bored weight or other arrangement for keeping the end in the liquid is attached, and to the other an olive-shaped vulcanite end-piece flattened on one side to fit into

a nostril. By introducing the latter into a nostril, closing the other nostril and the mouth, and inhaling, the liquid is drawn into the tube and the siphon set in action. If the unoccupied nostril is now opened and the head bent down, the fluid runs up one side of the nose and down through the other, and is discharged through the open nostril. For the application of ammonium chloride fumes see page 53.

The *larynx* may be influenced by inhalations, by insufflations, and by the local application of substances by means of probes, syringes, or similar instruments, and a laryngeal mirror.

The *trachea and bronchi* can be affected by inhalations, insufflations, and injections. The mucous membrane is comparatively insensitive to and is capable of quickly absorbing medicinal substances. It has even been utilised as a channel of absorption for drugs; an aqueous solution of the drug being injected by means of a syringe through the membrane between the first and second cartilaginous rings of the trachea. This method, however, has nothing to recommend it, and nowadays intratracheal injections are always made through the glottis. A special syringe and a laryngoscopic mirror are required, and a certain amount of manual dexterity is necessary. The injection should be made rapidly, and the sensitive parts of the glottis and epiglottis avoided. Some difference of opinion exists regarding the value of the method in pulmonary tuberculosis, but there can be little doubt that the trachea and larger bronchi can be influenced in this way. As much as 3 to 4 ounces

(75 to 100 Cc.) of fluid has been injected without danger, and even without serious ill-effects, but such large quantities are very rarely required.

Affections of the *conjunctiva* may be treated with aqueous solutions, powders, ointments, or lamellæ. Aqueous solutions, which as far as possible should be non-irritating, are dropped on to the conjunctiva (outer canthus) while the lids are retracted and slightly everted, and the chin turned well up. They may also be applied by means of an eye cup or an eye douche; or, if powerfully irritant solutions are being used, by a glass rod or cotton-wool on a glass rod. Powders are best flicked on with a brush, or, after being dipped in the powder, the brush may be held horizontally with the thumb and middle finger over the everted lids, and gently tapped with the end of the index finger. Ointments are applied with a glass rod or brush, and lamellæ are merely placed on the inner surface of the lower lid and allowed to dissolve. [Sub-conjunctival injections have been used for deep-seated inflammation and detachment of the retina.]

The *bladder* is usually treated by irrigation with warm aqueous solutions. The apparatus, which generally consists of a catheter, a rubber tube, and a receptacle (funnel, etc.) for the fluid, should be sterilised. The catheter is first passed, and the urine allowed to run off. The tube filled with fluid is then attached to the catheter, and the bladder filled and emptied by a siphon action. A three-way tube or stopcock, or a double-way catheter, is sometimes a convenience. Small quantities of emulsions (iodoform, etc.) are occasionally injected through a

catheter into the bladder, and after a short interval the excess is allowed to flow out.

The *urethra* is treated by means of aqueous injections, suppositories (bougies, antrophores), and occasionally with ointments and powders. Powerful drugs may be applied to definite parts by means of an endoscope or by special syringes. Generally a dilute solution of a drug is employed and is injected by means of one of the many forms of urethral syringe; or it may be administered under the pressure of a column of the fluid. Such injections, however, only affect the anterior part of the urethra. If the posterior part is diseased, the solution should be passed through an ordinary catheter into the bladder, and the urethra influenced by the natural discharge of the fluid; or a special catheter may be employed. In all cases the instruments should be sterilised, and before injection of the fluid urine should be voided in order to cleanse the mucous membrane of secretion.

Diseases of the *vagina* are usually treated by means of injections, but pessaries, ointments, and powders are also used. Local applications may be made with a tampon or a probe and a speculum. Injections are usually made with a Higginson's syringe or an irrigator. The normally contracted uterus may be treated with bougies, or drugs may be applied by means of cotton-wool on a uterine sound or probe. For local treatment of a part of the endometrium dilatation of the cervix is usually necessary.

In applying toxic solutions to mucous mem-

branes the possibility of absorption should not be forgotten. All mucous membranes absorb in greater or less degree; the vesical mucous membrane to a very slight extent, the mucous membrane of the respiratory tract rapidly and completely. Toxic effects have frequently resulted from the application of a drop of 1 per cent. atropine solution to the eye, the channel of absorption in this case, however, being mainly the lachrymal duct and alimentary mucous membrane.

The stomach.—The alimentary canal forms the most usual channel for the administration of medicines. Medicines so administered may be given to act locally upon the stomach or intestines, or may be intended to be absorbed into the blood. In both cases the forms of administration are the same. Most frequently the remedy is given in aqueous solution or suspension (mixtures, emulsions, etc.), because this offers the best means of obtaining its action on the stomach or its absorption into the circulation; but for special purposes or as a matter of convenience, pills, powders, confections, tablets, lozenges, and similar preparations are also used. The advantages and disadvantages of these forms will be mentioned under each, but it may not be out of place to emphasise here that that form should be used which will best attain the object in view and will derange the stomach least.

Medicines administered by the stomach are, speaking generally, absorbed but slowly. With few exceptions (hydrocyanic acid, nitroglycerin, pilocarpine salts, and substances equally diffusible),

none are absorbed to any marked extent.[1] They are mainly diluted by—unless they interact chemically with—the gastric contents, and gradually pass on with these into the intestines, where most of them are more or less quickly absorbed. This relatively slow absorption possesses a corresponding advantage—it enables us with repeated administration to obtain a fairly uniform effect of a remedy.

Oils and fats undergo but little change in the stomach when administered as such, but substances in solution in them, if soluble in the gastric contents, diffuse into and are dissolved by the gastric contents until the concentration of the substances in the two solvents is proportionate to their solubility in each (see page 21). If, however, the oil or fat is administered in the form of an emulsion, it is hydrolised to a greater or less extent by a lipase. Excess of acid retards and may inhibit this action, but otherwise the finer the emulsion, the greater is the decomposition.

If it is desirable to avoid the action of the gastric contents on a remedy, it is usual to administer it in the form of a pill coated with some substance insoluble in the gastric but soluble in the intestinal contents. The substances used as coatings are keratin, salol, and glutol, and are referred to later (page 189).

The *contra-indications* to the administration of

[1] Experimental evidence seems to point to the fact that, within limits, the greater the concentration of a drug in the stomach, the better are its chances of being absorbed by the stomach. The presence of alcohol accelerates the absorption of drugs by the stomach.

medicines by the stomach are, in the main, conditions interfering with the act of swallowing, and, if a general action is intended, gastric and intestinal diseases. An obvious example of the first class is complete stricture of the œsophagus, but unconsciousness and certain nervous diseases (advanced labio-glosso-laryngeal paralysis, hydrophobia, etc.) also belong to the same group. In some of these cases the difficulty of administration can, however, be overcome, if necessary, by the use of the stomach tube. The gastric and intestinal conditions which contra-indicate to some extent this mode of administration are those preventing or hindering the absorption of remedies. Repeated vomiting, severe diarrhœa, long retention of the gastric contents, as in marked dilatation of the stomach, are cases in point. Alterations in the blood-supply of the stomach and intestines also often interfere with absorption and diminish or prevent the action of drugs. Of these the venous congestion occurring in heart disease and the deficient circulation associated with collapse may be mentioned.

The rectum.—The mucous membrane of the rectum is able to absorb a number of foods and drugs, and is often used for this purpose when it is inadvisable to administer food or medicine by the mouth. In general it may be said that only substances soluble in water or capable of being transformed into soluble products are absorbed in this way, and that for most drugs the rate of absorption approximates to that of the same drug given by the

mouth. In some cases (strychnine salts in solution) absorption is quicker; in others (quinine sulphate) it is slower. As regards foods, albumins are absorbed slowly, albumoses and peptones fairly rapidly; sugars are easily absorbed, oils and fats scarcely at all. A considerable quantity of starch (50 grammes per diem) can be digested and absorbed by the rectum, and diluted alcohol is readily absorbed and increases the rapidity of absorption of other substances.

The food or drug may be applied in a liquid form, when it is termed an enema, or in a solid form, known as a suppository. Ointments are occasionally applied, but only for a local action. An *enema* varies in bulk, partly according to whether it is intended to be absorbed or not, partly according to the distance along the intestine it is intended to penetrate, partly owing to the properties of the drug. Nutrient or medicinal enemata intended to be absorbed are small in bulk, usually about 4 to 5 oz. (120 to 150 Cc.); those intended to act locally on the rectum or large intestine are generally large, and vary from ½ to 2 pints (300 to 1,000 Cc.) or even more. Glycerin enemata, however, which are used to produce a laxative effect, are very small, and rarely exceed ½ oz. (15 Cc.).

Enemata are administered by means of a syringe, various varieties of which exist. Whatever form be used, the injection should be given with as little discomfort to the patient as possible. The patient should be placed on the side with the knees drawn up; the nozzle of the syringe should be lubricated with oil or vaseline and passed beyond the sphincters, and the injection should be given slowly and as uniformly as possible. Rapid and intermittent injection over-distends the

lower part of the rectum, and besides producing discomfort often causes rejection of the liquid before it has accomplished its purpose. Even when properly administered, enemata usually cause a desire to evacuate at first, but the discomfort is readily borne and in part passes away. If it is desired to act locally on the sigmoid flexure or to reach the large intestine, a long rectal tube which can be passed up to the sigmoid flexure should be used, and the injection made under the pressure of a column of the fluid.

Irrigation of the whole intestines from the rectum has been practised, a gentle constant pressure being maintained with the patient in the knee-elbow position until vomiting of the fluid occurs. About 14 pints (8 litres) of fluid is necessary for an adult. It is not, however, a method to be recommended.

Suppositories are usually small in size—about 15 to 30 grains (1 to 2 Gm.)—and are made of such a shape as will facilitate their introduction into and subsequent retention by the rectum. They must be sufficiently hard at the temperature of the air to enable them to be handled with ease, and must melt below the temperature of the body in order that the medicament they contain may be set free to act on or be absorbed by the mucous membrane of the rectum. The excipients most commonly used in their preparation are cacao-butter (Oleum Theobromatis) and gelatin jelly (see page 208). As a rule their administration causes little or no discomfort, but absorption from them is somewhat slower than from an aqueous solution.

The method of administering *food* and drugs per rectum for a general action is resorted to in cases where it is impossible or inadvisable to give them by the stomach. In acute gastric diseases, for

example, it is often desirable to relieve the stomach of work, and this may be done for a time by rectal medication and alimentation. Nutrition, however, cannot be maintained for long in this way; after a few weeks the patient usually begins to lose strength rapidly, although cases have been described in which nutrition has been maintained for over three months. With repeated administration the rectal mucous membrane also becomes more irritable and retention of the enema more difficult. To avoid this the enema should be made as unirritating as possible, and injected at the body temperature and at intervals of not less than five to six hours. An hour previous to administration the rectum should be cleansed with alkalised salt solution or a boric acid solution, containing a sedative if necessary.

Enemata of *large bulk* are given to empty the rectum and large intestines of fæcal accumulations and worms, or to act upon an inflamed mucous membrane. In all cases it is advisable to administer the enema at or near the body temperature, although this is of less importance in the case of oil than of aqueous enemata. The kinds of enemata employed are given on page 153.

Ill-effects from the use of enemata rarely occur. Repeated use often produces some atony of the rectum, which, however, may be overcome by lowering the temperature of the enema, or, better, by increasing its bulk; and the careless introduction of the long rectal tube has produced laceration of the mucous membrane. In cases of an inflamed or lacerated mucous membrane (dysentery, etc.), overdistension should be avoided.

Similarly, *contra-indications* to the use of suppositories and enemata are few. Obstruction of the rectum, anal fissure, and inflamed hæmorrhoids are the chief, although in these the condition of the disease is of more importance than its existence. Such diseases, indeed, may be treated by these forms of medication.

The endermic method.—This is mainly of historical interest. It was employed previous to the introduction of the hypodermic method to obtain the rapid action of a drug and avoid its local effects upon the alimentary canal. It consists in raising a blister by means of strong ammonia solution or other preparation, and, after removing the raised epidermis, sprinkling the drug (usually a morphine salt) upon the exposed part. It has been recommended for its combined effects in the treatment of neuralgia and similar forms of pain. It is not, however, of sufficient interest to merit further consideration.

Hypodermic administration.—This is one of the most rapid and certain methods of administration. It consists in injecting the drug, generally in aqueous solution, under the skin by means of a special syringe to which a sharp hollow needle is attached. Various kinds of hypodermic syringes may be obtained, but whatever kind be adopted it should be capable of being thoroughly sterilised without injury. In using it for administration the liquid for injection is drawn up into (or sometimes prepared in) the barrel of the syringe, the needle is adjusted, and the air is expelled, if necessary, by pushing up the piston until the barrel and needle are filled with fluid. A fold of skin is next pinched up from one of the least sensitive parts of

the body (the back, or the back of the thigh or arm), and, with the syringe held almost horizontally, the needle is pushed rapidly and boldly under the skin at the base of the fold. The injection is then made by pushing the piston slowly and uniformly until the required dose has been administered. Aseptic precautions should be employed throughout, or, if this is not possible, as near an approach to asepticism as is possible should be obtained. The syringe should be kept ready sterilised, and if a sterilised solution is not or cannot be prepared, recently boiled and cooled water should be used in making the solution. The skin at the place of injection should be washed with ether or alcohol and afterwards with carbolic lotion, and the point of injection subsequently closed with an antiseptic collodion. The neglect of aseptic precautions is liable to give rise to abscess, and has produced even more serious sequelæ.

Owing to the sensitiveness of the subcutaneous tissue and the difficulty of quickly injecting a large bulk of fluid without interfering with the blood-supply to the superincumbent skin, thus rendering it liable to slough, this method of administering drugs has its *limitations*. It is best adapted for powerfully-acting substances which are sufficiently

[1] The epigastrium and the anterior part of the thorax are often used; they are more sensitive than the parts mentioned, but absorption is said to occur more quickly from them. According to Eulenburg and Denis, the following order represents the rapidity of absorption of various parts of the body—temples and cheeks, epigastrium, anterior part of thorax, supra- and infra-clavicular regions, inner side of arms and thighs, nape of neck, outer part of arms and thighs, forearm, leg, foot.

soluble in water to permit of the necessary dose being dissolved in not more than 15 minims (1 Cc.). Larger quantities are sometimes injected, and in some cases (*e.g.*, antitoxic sera) are necessary, but as far as possible large injections should be avoided (see, however, page 43). It is also desirable that the solution should be non-irritating, a matter which has not yet received the attention it deserves. The drug is commonly dissolved in more or less sterilised water, thus forming a hypotonic solution which is decidedly painful when injected beneath the skin. The use of a saline solution isotonic with the lymph would diminish this to a considerable degree. Hypodermic injections, however, are not limited to non-irritant substances, or even to substances soluble in water, but as these injections are better made into muscle they will be dealt with under intramuscular injections.

The *advantages* of rapid and certain action, accurate dosage, and absence of local action on the alimentary canal have given this method a wide application. Numerous cases are on record in which a drug has proved beneficial when administered hypodermically after being tried without success by the mouth. In such cases, generally grave, the advantages far outweigh the inconveniences of the method. The continued pain produced by irritant substances can be diminished or annulled by the addition of a small amount of a local anæsthetic to the solution, if compatible, and by injecting deeply into muscles (see page 45).

The *disadvantages* of the method are dependent on the physical characters and pharmacological

action of the drug, and on certain inconveniences to which it may give rise. It is not suitable, speaking generally, for irritant substances, for substances insoluble in aqueous media, or for substances which must be given in large quantities to produce an action (see, however, pages 43, 45). The main inconveniences are the precautions which must be taken in administration and the pain and other occasional ill-effects it causes. The pain of the puncture and the subsequent pain due to infiltration of the tissues are generally comparatively slight, but the employment of irritating substances, large quantities of fluid, or unclean apparatus may give rise to all grades of inflammation up to complete sloughing of the surrounding tissues. In rare cases a nerve has been injured, most frequently by the injection of ether; and occasionally the needle has been pushed into a blood-vessel and the injection made into the circulation with serious results. This can best be avoided by withdrawing the needle a little after introducing it into the subcutaneous tissue.

The *contra-indications* to the method are few. In diseases associated with a morbidly depressed vitality of the tissues, such as occurs in advanced diabetes and in paralysed and œdematous areas, hypodermic administration is generally inadvisable on account of the serious inflammation which is liable to ensue and the deficient absorption which occurs; nor, owing to the pain it causes, is it a suitable mode of administration, except in cases of emergency, for young children.

Absorption occurs both along the lymph chan-

nels and into the capillaries. The rapidity of absorption depends upon the physical characters of the drug and the medium in which it is administered. In the case of substances readily soluble in water an effect is obtained, or absorption into the circulation can be shown to have occurred, usually in a few minutes after the injection. If the same drug were administered in solution by the mouth, half-an-hour or more would probably elapse before absorption could be demonstrated.

In the case of a few rapidly diffusible substances (*e.g.*, hydrocyanic acid, pilocarpine salts, etc.) which are absorbed through the gastric wall, the difference in time of action between hypodermic injection and administration by the stomach is not great. Thus, to take the least favourable example, after the injection of $\frac{1}{16}$ grain (0·004 Gm.) pilocarpine under the skin of the calf of the leg, slight salivation appeared in three minutes; after taking $\frac{1}{6}$ grain (0·01 Gm.) by the mouth, an effect appeared in twelve minutes. [Pilocarpine salts are not usually given by the mouth, because when so administered they cause nausea more readily, owing to a local action on the stomach.]

Besides being used to produce a general action the hypodermic method is employed to obtain a *local effect.* Some local anæsthetics (cocaine, etc.) are given in this way. In these cases absorption is undesirable and should as far as possible be prevented.

The *hypodermic injection of large quantities* of a physiological saline solution, of a 5 per cent. glucose solution, and of olive oil has been practised within recent years; the first in order to introduce considerable quantities of water into the circulation in conditions of intoxication and collapse (see intravenous

injection, page 46), the second as a readily assimilable food, the last to aid in feeding the patient. The injection should be made into loose subcutaneous tissue (the axillary region, over the chest or abdomen, or between or below the scapulæ), and for the purpose a large hypodermic syringe, a flask and rubber tubing, or a Woulfe's bottle arrangement may be employed. The strictest aseptic precautions must be observed, the injection must be made slowly and be accompanied by gentle massage of the part, and the temperature of the liquid should be about 104° F. (40° C.) so that it enters the subcutaneous tissue at the body temperature. With care from 7 to 9 oz. (200 to 250 Cc.) can be injected at one place; if larger quantities are required two or more places of injection should be chosen.

The advantages of administering a saline solution in this way over intravenous injection are the greater ease of administration and the less serious ill-effects likely to follow inefficient asepsis or the accidental injection of air. The disadvantages are a less rapid and certain action owing to less efficient absorption, and slight continued pain.

An *intercutaneous method* of administration is first used to produce Schleich's infiltration anæsthesia. A physiological saline solution containing a small quantity of a local anæsthetic (*e.g.*, sodium chloride 0·8, β eucaine 0·1, distilled water 100·0) is injected *into* the skin until a small nodule is formed. The injected fluid by pressure causes anæsthesia of the infiltrated skin, and when this has occurred the needle is pushed on, and a second small injection made. The process is continued, and performed from one or more points until a sufficient area has been anæsthetised. When the skin is

incised most of the fluid injected escapes, so that practically no absorption of the local anæsthetic, which is added to diminish the pain of the process, occurs. The method is most suitable for minor operations and operations for hernia, but many major operations have been performed with it.

Intramuscular injections are used when it is desired to administer aqueous or oily solutions of irritant drugs, or suspensions, by a subcutaneous method.

The same aseptic precautions must be used as in the case of hypodermic administration, but the manner of injecting is slightly different. The skin, usually of the buttock, is stretched and pressed on with the fingers of the left hand, the syringe is held vertically to the plane of the skin, and the needle, which should be longer and stronger than a hypodermic needle, is rapidly pushed deep into the muscle. The so-called hypodermic injection of ergot is usually given in this way, as are calomel and other insoluble substances suspended in an aqueous medium and also oily solutions and suspensions.

The advantages and disadvantages of the method are the same as those of hypodermic injections. There is greater liability, however, for the needle to break in situ owing to the sudden contraction of the muscle, but the pain subsequent to the injection is relatively less and there is less liability to abscess formation.

Absorption of aqueous solutions occurs along the same channels as in hypodermic administration, and it is therefore only necessary to consider the absorption of substances insoluble in or immiscible

with water. Calomel and olive oil may be taken as types. Calomel in contact with the tissues is partly converted into a soluble compound (probably a mercuric compound) and absorbed by the lymphatics and blood-vessels, and is partly taken up by leucocytes and converted into a soluble compound within these. Oils are in the main gradually emulsified and absorbed through the lymphatics into the circulation, in which the minute oil globules rapidly disappear.

Intravenous injection is rarely practised. It possesses obvious advantages—a more rapid action and more accurate dosage than hypodermic administration even — but it necessitates a slight operation, and this, together with the greater liability to septic infection, more than counterbalances, in most cases, its advantages. In certain conditions of a grave nature, however, it has been employed. Thus malignant cases of malaria and of syphilis have been found to be more rapidly and effectively treated by this than by any other method.

The indications for administration by this method are (i.) the necessity of a very rapid action, as in poisoning by hydrocyanic acid; (ii.) an inefficient state of the circulation which renders absorption by any other method slow and ineffective, as in conditions of collapse.

A few drugs have also a different action when injected intravenously than when administered in other ways, but only one of these—viz., the active principle of the suprarenal gland—is likely to prove of therapeutic value. The general action of this substance can only be effectively obtained when it is injected directly into a vein.

The intravenous method is most frequently employed for the injection of large quantities of a physiological saline solution with the intention of diluting the blood and securing excretion in some intoxications (uræmia, diabetic coma, cases of poisoning), or of further filling the blood-vessels as in conditions of collapse. A slightly alkalised salt solution (0·8 per cent. NaCl + 0·1 per cent. $NaHCO_3$) may be used, and is apparently as efficacious as more complex solutions. The solution should be sterilised and injected at a temperature slightly higher than that of the blood. Small quantities of drugs (alcohol, etc.) may be added if required.

The method of intravenous injection.—The injection is most frequently made into one of the veins at the bend of the elbow, but any superficial vein of sufficient size and sufficiently far away from the heart may be employed. Apparatus and fluid for injection should be sterilised. A bandage is passed a few times round the arm to impede the venous return, and the skin at the bend of the elbow cleansed with alcohol and antiseptic lotions. An incision is then made somewhat obliquely through the skin over the most prominent vein (usually the medium basilic) and the vein cleaned for a short part of its course. Two ligatures are next passed under it and the distal one tied. A V-shaped incision, involving rather less than half the circumference of the vein, is now made with scissors pointing proximally, and the cannula, attached to the apparatus and filled with warm fluid, is inserted and fixed with the proximal ligature. The bandage is slackened, and the fluid, at a temperature slightly above the body temperature, is allowed to flow slowly (2 to 4 oz.—50 to 100 Cc.—a minute) into the vein. After a sufficiency (2 to 3½ pints—1 to 2 litres) has passed, the cannula is withdrawn, the vein ligatured, and the wound closed and dressed.

In cases of extreme urgency, if only a comparatively small quantity of fluid is being injected, a hypodermic needle attached to a syringe filled with fluid may be passed in a nearly horizontal direction straight into a vein.

Intraserous Injections.—These are used only to produce a local action on the serous membrane or its immediate environment, and are employed usually in conjunction with aspiration of fluid from the part. A trocar and cannula is generally used, but the principles of administration are similar to those of hypodermic and intravenous injections. Serious ill-effects are uncommon, but it should not be forgotten that serous membranes absorb fairly readily, and therefore the use of relatively large quantities of poisonous drugs may lead to toxic symptoms.

Lumbar Puncture.—A method of producing anæsthesia of the lower part of the body (from the costal arch downwards) by injecting solutions of local anæsthetics into the subarachnoid space has been extensively practised of recent years. The injection is best made with a special trocar and cannula and a syringe, but a hypodermic syringe with a long stout needle may be employed. The apparatus and the solution must be sterile, and the skin at and around the place of puncture should be thoroughly cleansed with alcohol or ether and an antiseptic lotion. The skin at the site of injection may be anæsthetised, if necessary, by the methyl-chloride spray. The puncture is usually made between the second and third or third and fourth lumbar vertebræ. The position of the fourth lumbar spine (which is on a level with the highest part of the iliac crest) is first determined, and the trocar and cannula is introduced about $\frac{3}{8}$ inch (1 cm.) to one side of it or of the third lumbar spine. It is pushed in a direction slightly upwards and towards the median line until it enters the subarachnoid space, which is known by subarachnoid fluid flowing from the cannula when the trocar has been withdrawn. When 1 to $1\frac{1}{2}$ fluid drachms (3·5 to 5 Cc.) of fluid has passed, the same quantity of warm physiological saline solution containing the local anæsthetic is slowly injected. Analgesia of the lower limbs usually com-

mences in about five minutes, and the complete anæsthesia generally lasts from half to one hour. Ill-effects—most commonly headache, but also fever, delirium, convulsions, cardiac irregularity, collapse, etc.—have occurred fairly frequently, and especially after the use of cocaine. The newer, less toxic local anæsthetics are said to produce no serious after-effects. Bier also states that they may be avoided by placing a rubber band round the neck to produce cerebral congestion, and allowing it to remain in position for two hours after the operation is completed.

Inhalation.—In practice this term is applied to the administration of any substance which is taken into the upper air passages or the lungs by the act of inspiration. The method is employed for gaseous substances (gases and the vapour of substances sufficiently volatile at the temperature of the air or of warm water) and for substances in a finely particulate form (fumes and clouds).

The degree of *penetration into the lungs* depends mainly on the volatility of the substance and the mode of administration. If the substance is a gas or vapour at ordinary temperatures, and non-irritant, it will penetrate into the pulmonary alveoli by the act of inspiration and the process of diffusion, and will subsequently pass to a greater or less extent into the blood circulating through the pulmonary vessels. If, however, the substance is in a particulate form it will not pass, unless breathed for long periods, appreciably beyond the mucous membrane of the medium-sized bronchi; and the same is true of vapours which only remain such at temperatures considerably above that of the body. Absorption of such substances

may occur through the bronchial mucous membrane into the blood and lymph vessels, but, owing to the dilutions used, for practical purposes this is negligible. Absorption of gases and vapours by way of the pulmonary vesicles is extremely rapid; the effect of an inhalation of amyl nitrite on the pulse can usually be shown within ten seconds of the commencement of inhalation. This is due largely to the extensive absorbing surface (roughly 100 sq. meters) exhibited by the lungs and the thinness of the membranes (about $\frac{1}{1000}$ mm.) separating the air of the pulmonary vesicles from the blood. The process of absorption itself is largely if not wholly a physical or combined physical and chemical phenomenon.

The *method of administration* depends mainly on the physical characters of the substance and the concentration and duration of action required. A gas can only be satisfactorily administered by means of a mouth or face piece and a reservoir; volatile liquids or solids may be given in various ways. If the liquid is sufficiently volatile it may be dropped on a handkerchief, a towel, or a piece of lint, and held to the mouth and nose (amyl nitrite and, with certain precautions, chloroform are given in this way); but ether, to produce general anæsthesia, cannot be conveniently administered so, because, although more volatile than amyl nitrite or chloroform, a much larger concentration is needed to induce the required effect. Consequently a special apparatus must be employed (Clover's ether inhaler or a modification of it). The lesser volatile substances are given in various forms of inhalers

and respirators. One of the simplest and best respirators is the perforated zinc form designed by Yeo. In shape it is of the form of a truncated cone; the circumference of the base is covered with soft material to adapt it more comfortably to the skin around the mouth and nose; the truncated apex consists of a chamber in which sponge or cotton-wool, more or less saturated with a medicament, is placed. During inspiration the patient inhales the volatilised drug along with the inspired air.

For drugs which are insufficiently volatile at the temperature of the air, or when the action of aqueous vapour is also required, warm water is employed. The simplest apparatus is a narrow-mouthed jug. This is partially filled with hot water, and when the temperature has fallen to 115° to 120° F. (46° to 50° C.), the medicament is added, and the mouth of the jug covered with a piece of paper or a towel in the form of a cone, through the narrow end of which the patient inhales. An arrangement on the principle of the Woulfe's bottle is more efficient and is advisable if the inhalation is to be continued more than a few minutes. In this case the temperature of the fluid should be maintained at about 120° F. (49° C.), but should not be allowed to rise much above that point. Various forms of apparatus can be bought.

If a substance is non-volatile or very slightly volatile, it is necessary to volatilise it by dry heat or to administer it in the form of a cloud by means of a spray apparatus. In some cases the substance can be smoked (as cigarettes, etc.) or be made into

fumigating pastilles or similar preparations which on igniting produce fumes which may be inhaled. In most cases a spray apparatus must be used.

The principle of the spray is that of an injector, and consists fundamentally of two tubes which terminate in narrow openings flush with and in close proximity to one another. One tube, usually narrow in bore, dips into the liquid; the other is connected with a piece of apparatus (usually a valved rubber ball) to produce a blast of air. When a rapid current of air issues from the jet of the latter tube a negative pressure is created at the orifice of the first tube, which causes liquid to be drawn up, and this is subsequently dispersed as a cloud by the blast. For more viscous liquids the size of the openings must be increased and the strength of the blast must be correspondingly increased to create the same negative pressure.

Any liquid can be employed in a properly adapted spray. The liquid (usually an aqueous, oily, or a paraffin solution) is heated to 80° to 85° F. (27° to 30° C.). The nozzle of the spray, held about 8 to 10 inches (20 to 25 cm.) from the patient, is directed towards the mouth, and the cloud is inhaled. The mouth should be widely opened, the tongue put well out and the tip depressed, and the inspiration should be slow and deep. Although only a small fraction of the cloud taken in by the mouth passes beyond the glottis, the mucous membrane as far as the large bronchi can be influenced in this way. In the case of cigarettes a deep inspiration should be taken after the fumes have been drawn into the mouth. If the fumes are too irritating to permit of this, exhalation into a vessel and re-inhalation should be tried.

The *duration* of inhalations varies with the

substance employed, the manner in which it is given (*i.e.*, mainly with its concentration), and the condition for which it is employed. Speaking generally, inhalations should be of a few minutes' duration at first and the time gradually increased to 15 to 20 minutes. After inhalations from warm water the patient should be retained in the room for 20 to 30 minutes.

In the case of *ammonium chloride fumes* a special apparatus is usually employed. This consists of two vessels, containing a solution of ammonia and hydrochloric acid respectively, through which air is drawn by inspiration into a common chamber. Here the vapours of the ammonia and hydrochloric acid unite and form white fumes of ammonium chloride, which, after passing through water or a damp sponge (to take up any free ammonia or hydrochloric acid gas), are inhaled through a mouthpiece. These fumes are used mainly for a local action on the pharyngeal and nasal mucous membranes, and consequently are exhaled through the nose.

At certain spas special rooms are employed for administering drugs, and especially natural waters, by inhalation. The air of the room is impregnated to the proper concentration of the drug, and patients live in the room for a prescribed time each day. Small portable rooms have been employed to give creosote inhalations in the treatment of phthisis and of bronchiectasis. In these a considerable concentration of creosote vapour is obtained usually by the aid of heat.

CONDITIONS AFFECTING THE ADMINISTRATION OF MEDICINES

The only conditions it is necessary to refer to here are (i.) the weight of the patient, (ii.) the time and (iii.) the frequency of administration. Conditions which modify the action of drugs (the disposition and age of the patient, the existence of tolerance or intolerance, the presence of disease, etc.) are more appropriately dealt with in works on pharmacology; and those which are associated with the physical characters of drugs are considered in other parts of this work.

(i.) As a drug given to produce a general effect must be absorbed into the blood and act through the circulation, the dose of a drug,[1] speaking generally, should be adapted to the *body-weight*. It is unnecessary, however, to weigh each patient. A sufficiently approximate idea of the weight is gained from the size of the patient, and this is

[1] The true dose of such a drug is the quantity present in the blood at any one moment of time; the severity of action of the drug is dependent on the concentration of the drug in the blood and the time it acts. As some cells may possess a selective influence for the drug, and as different tissues do not increase *pari passu* with increase of weight of the body as a whole, calculations of dose according to body-weight are not always justifiable.

unconsciously employed in adjusting the dose. An average woman requires about five-sixths the dose for an average man. The greatest discrepancies occur in the case of children, and consequently most of the rules and tables which have been formulated have reference to the age rather than the weight of the patient. For practical purposes this is generally a sufficient guide, but employed in this way it is apt to lead to the erroneous conclusion that it is age rather than body-weight which is of importance.[1] Of the various ways of estimating doses according to age, that of Young is the simplest and best for most purposes.

Young's Formula.—Take the age in years as the numerator and the age plus twelve as the denominator; the resulting fraction is the proportion of the adult dose to employ, *e.g.*:

For a child 1 year old $\frac{1}{1+12} = \frac{1}{13}$ of the adult dose.

For a child 4 years old $\frac{4}{4+12} = \frac{1}{4}$ of the adult dose.

The formula was adapted to the metric system by Brunton as follows: Let the adult age be regarded as 25; take this as the denominator and (after the first year) the age of the child *next* birthday as the numerator; the resulting fraction indicates the proportion of an adult dose to use. By multiplying the numerator by 4 the percentage

[1] The influence of age as a modifying factor on the action of drugs is dependent not on body-weight but on different physiological functions and relationships. These play but a small part, except in a few cases. Children bear much larger doses of belladonna and are susceptible to much smaller doses of opium than their weight would indicate.

proportion of the dose is obtained. For a child two years old $\frac{3}{25} = \frac{12}{100}$, and thus by multiplying the metric dose by 12 and readjusting the decimal point the dose is found.

(ii.) The *time* at which medicines should be taken or administered is too frequently ignored by prescribers. In the majority of prescriptions no definite instructions are given on this point; and this occasionally forms a ground for complaint. It may be immaterial in some cases at what time the medicine is given, but this is not the case in all or even in the majority; and in all cases it is a wise policy to make the directions as definite as possible. Unless this is done the patient or nurse is left in doubt, and this tends to destroy confidence.

The time of administration should have reference to the physiological needs of the body—*e.g.*, sleep and meals—rather than to actual times, except in special instances. Speaking generally, medicines intended to act upon the stomach should be given before meals; most others, unless reasons to the contrary exist, are better administered an hour and a half to two hours after a meal. At this time the gastric contents are being passed into the duodenum, so that the medicine is not delayed unduly in the stomach and has less tendency to derange digestion. If the medicine has an irritant effect upon the gastric walls—as, for example, arsenical and mercurial preparations—it is advisable to administer it soon after meals, as thereby it becomes better mixed with the food and is well diluted before coming into contact with the stomach. If, however, it is also liable to cause unpleasant

eructations (*e.g.*, copaiba), it is better to delay its administration until about an hour after meals. Substances which are intended to act or may act as foods (*e.g.*, fatty oils and emulsions) are also best administered after food. But if a relatively rapid action is required it is better to administer the medicine before food, provided that it is unirritating, since absorption occurs more rapidly in this condition. Medicines for occasional use or for specific purposes are naturally given at the most opportune time; substances to produce sleep are given at or near bedtime, so that sleep may follow at the natural time; quinine is administered three to five hours before a malarial attack, so that the spores of the malarial parasite may be discharged into the most highly quininised blood. Slowly acting purgatives are administered at bedtime, so that an action may follow the next morning; but rapidly acting purgatives (saline and drastic purgatives) are given in the morning in order to avoid disturbances throughout the night. Similarly santonin is given at night to avoid the yellow vision which it commonly causes for some hours after its administration. In all cases the time of administration must be controlled by the action of the drug or by the effect it is desired to obtain from it.

(iii.) The *frequency* with which a drug shall be administered depends upon the pharmacological action of the drug, the manner of exhibiting it, and the result it is desired to accomplish with it. The only case that need be considered is that in which a comparatively uniform action of the drug is required. To obtain this it is necessary to know

not only the general pharmacological action of the drug, but also the extent and duration of action of definite therapeutic doses. In the case of medicines administered by the mouth it is advantageous in most instances to give them in relation to the chief meals of the day—*i.e.*, three times a day, as it is usually termed—but this is not frequent enough for some drugs which are transient in action (hydrocyanic acid, ammonium carbonate, nitroglycerin, etc.) and is sometimes too frequent for others (digitalin, atropine, arsenic, quinine, etc.) which produce a sustained action.

Thus a continued fall of blood-pressure cannot be produced by administering full doses of a nitroglycerin preparation three times a day, since the action of such a dose is mainly over in one hour and has quite disappeared in three hours; on the other hand, a continued effect of digitalin can be obtained by administering digitalin every night or even every other night. Similarly a continued mercurial action is produced by injecting a calomel mixture into muscle once week.

In many acute diseases, when light food only is being taken at short intervals, it is also often desirable to administer medicines frequently. Consequently in such cases medicines are usually ordered to be given every three or four hours. This usually means that the administration must be continued during the night as well as the day if the patient is not asleep.

SOLUTION

One of the necessities of accurate prescribing is a knowledge of solubilities. In the case of mixtures the prescriber should know whether the active ingredients are soluble in the quantity of menstruum he has ordered, or not. Fortunately, an accurate knowledge is rarely required, since in most instances drugs are readily soluble or relatively insoluble in the quantities of menstruum usually employed.

Speaking generally, water is the best solvent for inorganic substances (iodine, phosphorus, sulphur, some mercuric salts, and a few others are exceptions) and for organic salts of the alkali metals. Organic substances in general are most soluble in a solvent having some chemical analogy to them.

Organic substances containing hydroxyl groups are for the most part more or less soluble in water; and the more hydroxyl groups they contain relative to the number of carbon atoms, the more soluble generally they are. Thus ethyl alcohol and acetic acid are miscible in all proportions with water. But as we ascend the respective homologous series the solubility decreases; amyl alcohol [$C_5H_{11}OH$] is only slightly soluble in water. On the other hand, arabite [$C_5H_7(OH)_5$], which contains the same number of carbon atoms, but five hydroxyl groups, is readily soluble in water. Similarly, phenol [C_6H_5OH] is only slightly soluble in

water; resorcin [$C_6H_4(OH)_2$] is more soluble; and pyrogallo [$C_6H_3(OH)_3$] is very soluble.

Again, hydrocarbons are soluble in hydrocarbons—benzene dissolves all hydrocarbons to a greater or less extent—but are practically insoluble in water; and acetic acid dissolves all fatty acids without exception.

The solvents most commonly used in prescribing are water, alcohol, glycerin, fats and oils, and paraffins.

Water.—Water is by far the most important vehicle in the administration of medicines. Substances which are insoluble in water or which cannot be brought into solution in it exert no active pharmacological effect on tissues other than the skin (*cf.* pages 20, 23). It is therefore necessary to deal with the solubility of substances in this medium in some detail. Unfortunately, no concise and absolute rules can be laid down, but the following general statements may be helpful. Exceptions which are not likely to be of therapeutic importance, or of importance from the point of view of incompatibility, are not mentioned; and as no substance is absolutely insoluble in water, insoluble means relatively insoluble, or insoluble for most therapeutic purposes. The temperature is assumed to be the ordinary temperature of the air.

Soluble in water.

All inorganic acids, salts of alkali metals and ammonium. (Lithium carbonate is only slightly soluble—1 in 75.)

All normal metallic nitrates. (Basic nitrates —*e.g.*, bismuth subnitrate—are insoluble.

They are decomposed to some extent in contact with water.)

Most inorganic nitrites. (Silver nitrite and some double nitrites are very slightly soluble. Nitrous esters of organic compounds—*e.g.*, ethyl nitrite, amyl nitrite—are almost insoluble.)

Inorganic chlorides, bromides, and iodides, except those of silver, mercurosum, and lead.

Inorganic sulphates, except those of calcium, strontium, barium, and lead.

All chlorates except mercurous chlorate.

All acetates except quinine acetate.

Hypophosphites of the alkali metals and metals of the alkaline earths, except barium hypophosphite, which is only slightly soluble.

Acid salts are generally more soluble than normal salts, if the acid itself is more soluble than the normal salt.

The solubility of organic substances is dependent largely on the relative quantity of groups conferring solubility (*e.g.*, hydroxyl and amide groups) and those conferring insolubility (*e.g.*, hydrocarbon groups). Thus the greater the proportion of hydroxyl groups in relation to the number of carbon atoms, the greater in most cases is the solubility.

The hydrochlorides and nitrates of alkaloids are soluble. (Berberine hydrochloride is very slightly soluble.) The solubility of

other alkaloidal salts varies considerably; sulphates, acetates, citrates, and tartrates (except of quinine) are generally soluble, but iodides, and frequently bromides, are relatively insoluble.

Glucosides vary greatly in solubility, but most are sufficiently soluble for therapeutic purposes. The digitalis glucosides (digitoxin, digitophyllin, and pure digitalin) are almost insoluble.

Bitter principles are for the most part slightly, but sufficiently, soluble. They are generally more soluble in dilute alkalies.

Insoluble or but slightly soluble in water.

Hydroxides and oxides, except those of the alkali metals. Those of calcium, strontium, barium, and magnesium are slightly soluble.

Normal carbonates, phosphates, borates, sulphides, sulphites, citrates, tartrates, benzoates, salicylates, and most salts, other than those previously mentioned, excepting salts of the alkali metals. (Calcium monosulphide is soluble in about 500 parts of water.)

Most basic salts. Lead subacetate is soluble.

The predominance of hydrocarbon radicals in organic compounds tends to confer insolubility (see page 59).

Alkaloids (bases) are relatively insoluble. Atropine (1 in 300) and strychnine (1 in 7,000) are sufficiently soluble for most therapeutic purposes.

Resins, fixed oils, and fats are insoluble. Volatile oils are slightly soluble.

In the following table the drugs in common use are divided according to their solubility in water. The number after the drug indicates parts of water in which one part of drug is soluble:

1 in 1 (or less).

Chromic, citric, lactic, tannic, tartaric, and trichloracetic acids.

Caustic soda and potash, potassium acetate, carbonate, citrate, iodide, and tartrate; sodium acetate, bromide, chlorate, hypophosphite, iodide, nitrate, and salicylate; ammonium iodide; calcium chloride; magnesium sulphate; scale preparations of iron; silver nitrate; zinc chloride and sulphate.

Chloral hydrate, urethane, diuretin, cane sugar, atropine sulphate, cocaine hydrochloride, hyoscyamine sulphate, physostigmine sulphate, quinine acid hydrochloride.

1 in 1–5.

Formic acid (4), pyrogallic acid (3).

Ammonium bromide (2), ammonium carbonate (4), ammonium chloride (3), ammonium phosphate (2), copper sulphate (3), ferrous sulphate (2), gold sodium chloride (2), lead acetate (3), lithium citrate (2), lithium salicylate (3), magnesium citrate (2), potassium bicarbonate (4), potassium bromide (2), potassium chloride (3), potassium nitrate (4), sodium arsenate (5), sodium benzoate (2), sodium bromide (2), sodium carbonate (2), sodium chloride (3), sodium nitrite (2), sodium sulphate (4), sodium sulphite (2), sodium potassium tartrate (2), sulphurated potash (2), zinc acetate (3), zinc sulphocarbolate (3).

Antipyrin (2), caffeine sodium benzoate and salicylate (2), codeine phosphate (4), hydrastinine hydrochloride (2), hyoscine hydrobromide (4), hyoscine hydrochloride (2), morphine acetate (3), piperazin (2), pyridin (5).

1 in 5–10.

Ammonia-alum (10), ammonium benzoate (6), calcium hypophosphite (8), potassium bichromate (10), sodium phosphate (7), sodium sulphocarbolate (6).

Colchicine (5), ether (10), homatropine hydrobromide (6), milk sugar (7), paraldehyde (10), pilocarpine nitrate (7).

1 in 10–20.

Arsenium iodide (12), mercuric chloride (18), potash-alum (11), potassium chlorate (17), potassium permanganate (18), sodium bicarbonate (12), sodium pyrophosphate (12), tartarated antimony (18).

Carbolic acid (13), acetic ether (12), amylene hydrate (15), chloralamide (20), morphine tartrate (11).

1 in 20–50.

Boric acid (30), borax (25), apomorphine hydrochloride (50), butyl-chloral hydrate (40), morphine hydrochloride (25), morphine sulphate (20), quinine hydrochloride (35), salicin (30), strychnine hydrochloride (35), valerianic acid (30).

1 in 50–100.

Arsenous anhydride (80), camphoric acid (100), gallic acid (100), picric acid (90).

Caffeine (80), chloroform (100), codeine (80), lithium carbonate (75), strychnine nitrate (90).

1 in 100–200.

Acetanilide (200), aloin (120), creosote (150), physostigmine salicylate (150), zinc valerianate (120).

1 in 200–1,000.

Benzoic acid (400), salicylic acid (500), atropine (300), calcium hydrate (960), camphor (700), β-naphthol (1,000), nitroglycerin (800), picrotoxin (350), potassium acid tartrate (220), quinine sulphate (800), saccharin (360), sulphonal (450), terpin hydrate (250), trional (320).

Organic solvents.—The most important of these is alcohol; but glycerin, acetic acid, ethyl acetate,

acetone, ether, chloroform, fixed oils, petroleum, and benzene are occasionally used. Unfortunately, no general rule, other than that previously mentioned (page 59), can be laid down as a guide to the solubility of substances in these media. Speaking generally, alcohol dissolves most organic substances to a greater or less extent; and as regards solvent power the following order in one or other direction is often distinguishable : glycerin, alcohol, ethyl acetate or acetone, ether, chloroform, fixed oils, hydrocarbons—*i.e.*, a substance which is readily soluble in alcohol will probably be relatively insoluble in paraffins or benzene, and vice versa, the other solvents occupying the intermediate positions indicated. Alcohol, glycerin, oils, and paraffins require individual consideration.

Alcohol.

- Most inorganic salts are insoluble, except some iodides, bromides, and chlorides. The most noteworthy of these are sodium iodide, potassium iodide, sodium bromide, ammonium bromide, calcium chloride, zinc chloride, ferric chloride, and mercuric chloride.
- Hydroxides of the alkali metals are soluble.
- Organic salts of alkali metals are generally moderately soluble, except the citrates and tartrates.
- Alcohols, ethers, esters, organic acids, and phenols are soluble.
- Volatile oils, resins, and allied substances are generally soluble.

- Fatty oils are only slightly soluble, except castor oil and croton oil, which are readily soluble.
- Alkaloids (bases) and many of their salts are soluble.
- Glucosides, speaking generally, are less soluble than in water; but most of those insoluble in water are soluble in alcohol.
- Most sugars, gums, and proteids are insoluble.

The following are the solubilities of official drugs. The numbers indicate parts of alcohol which dissolve one part of substance.

Benzoic acid (1), boric acid (30), citric acid (1), lactic acid (1), salicylic acid (3), tannic acid (1), tartaric acid (3).

Acetate of lead (30), of potassium (2); bromide of ammonium (14), of potassium (120), of sodium (15); chloride of ammonium (170), of calcium (3), mercuric chloride (4), chloride of zinc (1); iodide of arsenium (50), of potassium (40), of sodium (10); phosphorus (320); caustic potash (3), sodium benzoate (25), sodium hypophosphite (30), sodium salicylate (30); zinc sulphocarbolate (3).

Acetanilide (4), antipyrin (2), camphor (1), carbolic acid (1), chloral hydrate (1), iodoform (80), menthol (1), β-naphthol (2), phenacetin (20), saccharin (30), thymol (1).

Aconitine (40), atropine (3), atropine sulphate (4), caffeine (40), cocaine (10), cocaine hydrochloride (3), hyoscyamine sulphate (3), hyoscine hydrobromide (20), morphine hydrochloride (50), physostigmine sulphate (1), picrotoxin (13), pilocarpine nitrate (150), quinine hydrochloride (1), quinine sulphate (65), strychnine (150), strychnine hydrochloride (60).

Glycerin.—As a solvent this occupies a place between water and alcohol. Substances which are soluble in water and insoluble in alcohol, or substances which are insoluble in water and soluble

in alcohol, are to some extent soluble in glycerin; and the solubility of substances soluble in both the first-named solvents is somewhere intermediate between the solubility in water and in alcohol with a nearer approximation to water than to alcohol. Exceptions to this rule occur in the case of substances capable of entering into chemical combination with glycerin (boric acid, borax, arsenious trioxide, lead oxide), and in the case of alum, which requires a considerable amount of water for its crystallisation. These substances dissolve in glycerin to a greater extent than in water or alcohol.

The following substances are soluble in glycerin. The number after each represents approximately the parts of glycerin which dissolve one part of substance. Solubilities in glycerin at ordinary temperatures are very difficult to determine accurately.

Arsenious anhydride (5), boric acid (2), carbolic acid (1), citric acid (2), tannic acid (1), tartaric acid (5).

Ammonium benzoate (8), borax (1), iodine (50), lead acetate (3), mercuric chloride (2), potassium iodide (3), sodium hypophosphite (2), sodium iodide (1), sodium sulphite (25), sodium sulphocarbolate (6), zinc chloride (5).

Chloral hydrate (1), cocaine hydrochloride (3), iodoform (100), morphine hydrochloride (8), β-naphthol (40), quinine sulphate (40).

Fixed oils and fats.—The solvent powers of the different fixed oils and fats vary considerably, but the following statements are true for most:

Ethers, chloroform, phenols, volatile oils, and hydrocarbons, and similar substances (ethyl acetate, chloral hydrate, creosote, thymol, naphthol, salol, menthol, camphor, waxes,

etc.) are readily soluble. [Iodoform is only moderately soluble—1 in 30 of olive oil.]

Aromatic acids (benzoic, salicylic) and the higher fatty acids are soluble. Glacial acetic acid is moderately soluble in most oils, and is readily miscible with castor oil.

Alcohol is, relatively, slightly soluble in most oils, but mixes in all proportions with castor oil and croton oil.

Glycerin is almost insoluble in oils.

Oleates are soluble.

Alkaloids (bases) are sufficiently soluble for therapeutic purposes. Their salts (except oleates) are for the most part insoluble.

The elements, iodine, sulphur, phosphorus, are slightly soluble (rather more than 1 per cent. in each case).

Inorganic salts are insoluble. [A trace of metallic oxides may be dissolved, as oils generally contain a trace of fatty acids.]

Hydrocarbons.—Of these the high-boiling liquid paraffins (Paraffinum Liquidum B.P., Petrolatum Liquidum U.S.P.) and soft paraffin are of greatest importance. The solvent action of these is somewhat similar to, but less powerful than, that of the fixed oils. The solubility of carbolic acid is 1 in 20, of camphor 1 in 4. The solubility of substances is largely increased by sufficiently warming the paraffins to make them limpid. Alcohol is almost insoluble in these menstrua.

Mixed solvents.—The employment of alcohol and other solvents in pharmacy renders necessary

some allusion to the part these play as solvents when mixed with water. Two cases present themselves for inquiry, the case of immiscible solvents having been already considered (page 21).

(i.) The substance is soluble in both solvents. In this case the solubility of the substance in a mixture of the solvents will be somewhere intermediate between its solubility in the two solvents separately Thus mercuric chloride, which is soluble to the extent of 1 part in 18 parts of water, and 1 part in 3 parts of alcohol, is soluble in 50 per cent. alcohol (by volume) to the extent of 1 part in $12\frac{1}{2}$ parts.

(ii.) The substance is soluble in one solvent and insoluble in the other. This is a common case, and it arises most frequently in connection with the use of alcohol (*i.e.*, alcoholic preparations) and water. Speaking generally, the solubility of a substance in a mixture of alcohol and water is less, and if the solvent in which the substance is not soluble is in marked excess is very much less, than the quantity of the dissolving solvent in the mixture would suggest. This is especially noteworthy in the case of resins and some inorganic salts. Thus the presence of alcohol (as tinctures, etc.) in medicines is liable to interfere with the solution of many inorganic salts if both are present in considerable quantities. And resins, although readily soluble in alcohol, are insoluble in the strengths of diluted alcohol which are given internally.

The following table gives the solubility of some common types of substances in water and various strengths of alcohol. The numbers represent

grammes dissolved by 100 Cc. of solvent at about 14° C.

—	Water	10 per cent. Alcohol by Vol.	25 per cent. Alcohol by Vol.	50 per cent. Alcohol by Vol.	99·5 per cent. Alcohol
Sodium Chloride .	36	31	22	11·7	0·2
Magnesium Sulphate	99	66	27	1·7	0
Cane Sugar . .	200	175	140	88·5	trace
Gum Acacia . .	all proportions	[1]	[1]	3·5	0
Resin (Colophony) .	0	0	trace	0·5	170

Solids affecting the solution of other solids.—Besides substances which are usually regarded as solvents, solids in solution also appear to act the part of solvents in some cases. But in nearly all if not all of these cases chemical change occurs, either double decomposition or the formation of complex ions. The examples may conveniently be divided into these two groups.

(i.) Double decomposition :

Salicylic acid, benzoic acid, gallic acid, and most other slightly soluble acids are more soluble in solutions of sodium or potassium phosphates, acetates, or citrates than in pure water. This is due to the fact that these salts, being combinations of weak acids and strong bases, act the part of weak alkalies, and consequently a certain amount of sodium or potassium salicylate, benzoate, etc., is formed.

[1] No proper solution of gum acacia in 10 per cent. or 25 per cent. alcohol could be obtained. The mixture showed white flocculi, but otherwise the gum seemed to go up in all proportions.

Phosphates (calcium, ferrous, etc.) are also more soluble in solutions of alkali citrates or acetates for a similar reason—*i.e.*, alkali phosphates are in part formed. They are also more soluble in dilute hydrochloric acid, citric acid, or acetic acid than in water, because the phosphate is more or less displaced by the chloride, citrate, or acetate, with the formation of metallic chlorides, citrates, or acetates, which are more soluble than the corresponding phosphates.

The solubility of potassium chlorate is notably increased by the addition of sodium carbonate or bicarbonate. In this case a certain amount of sodium chlorate and potassium carbonate or bicarbonate is formed, both of which salts are more soluble than the corresponding original substances.

Carbonates of calcium, magnesium, iron, etc., are made slightly soluble by the presence of carbonic acid in the water owing to the formation of the more soluble bicarbonates.

Alkaloids are more soluble in acidulated water than in ordinary water because more soluble salts are formed; and in some cases alkaloidal salts are more soluble in acidulated than in pure water owing to the formation of still more soluble acid salts. Quinine sulphate (solubility 1 in 800) and quinine acid sulphate (solubility 1 in 11) are notable examples in point.

Saccharin, santonin, chrysarobin, and most other neutral principles, are more soluble in alkaline solutions than in water or dilute

acids. In each case a compound, often coloured, is formed with the alkali metal.

Boric acid is more soluble in a solution of tartaric acid than in water because a borate is formed with the latter acid.

(ii.) Formation of complex ions :

Mercuric iodide is readily soluble in potassium iodide solutions, a double compound, potassio-mercuric iodide, being formed. And mercuric chloride is more soluble in solutions of sodium chloride or ammonium chloride for a similar reason.

Bismuth citrate is dissolved by solution of ammonium citrate, a complex compound being formed.

Iodine is readily soluble in potassium iodide solution. The solution may be regarded as composed of potassium iodide, potassium tri-iodide, and iodine.

Caffeine and theobromine are readily dissolved by solution of sodium benzoate or salicylate, a double compound being formed.

Acetanilide is readily soluble in a solution of chloral hydrate ; and quinine and its salts, and also many other alkaloids, are more soluble in a solution of antipyrin than in water. In each case complex compounds are probably formed.

Benzoic acid dissolves in strong solutions of sodium sulphite ; and strong solutions of sodium salicylate dissolve phenols, menthol, volatile oils, and resins.

INCOMPATIBILITY

Incompatibility may be physical or chemical. A third division—therapeutical—is usually added, but is unnecessary. It is applied to cases where two substances producing opposite physiological effects are ordered in the same medicine in doses likely to interfere seriously with one another's action. One of the best examples is a mixture containing pilocarpine and atropine, but it is doubtful if ever such a combination is prescribed. The question is one of antagonism, not of incompatibility, and properly belongs to works on pharmacology. Pharmacists apply the term therapeutical incompatibility also to prescriptions containing doses of drugs much above the ordinary, unless the intention to administer such doses is distinctly indicated on the prescription (see page 11).

Physical Incompatibility

This occurs when a prescription containing ingredients not acting chemically on one another cannot be successfully dispensed without modification. The most commonly occurring examples are—

(i.) The prescribing of two or more immiscible liquids without any means for their uniform admixture—*e.g.*, oils and water. But in reality a

mixture containing any liquid which is insoluble in the prescribed quantity of menstruum is an example of this class. Paraldehyde, when ordered in less than ten parts of water (*e.g.*, ℞ paraldehydi ʒj, aquam ad ℥j), is a case in point.

(ii.) The unforeseen separation of a substance, or mixture of substances, owing to the addition of a second solvent. Thus tinctures and other alcoholic preparations sometimes throw out salts from a mixture, and occasionally separation into two, or even three, layers occurs. Salts may also separate the volatile oil in aromatic waters.

(iii.) The existence of solids in a mixture in such a form as renders the mixture unsightly or prevents uniform apportioning of the dose. The addition of resinous tinctures to water leads to the separation of the resin, the particles of which in most cases cohere and form unsightly masses, which cannot be uniformly diffused through the water, and many of which frequently adhere to the sides of the bottle.

(iv.) The prescribing as powders of two or more solids which, when mixed, liquefy. In many cases this is the result of chemical action, but it is doubtfully so in all, and as the apparent action is a physical change it seems advisable to include this class in the physical group. The most important substances of the class are the phenols (carbolic acid, thymol, resorcin, β-naphthol, etc.), chloral hydrate (and butyl-chloral hydrate), camphor and menthol, and salol. Almost any two of these, when rubbed together at summer temperatures, will form a liquid or a soft

pasty mass. Cold, however, retards and may even prevent the change. Acetanilide, phenacetin, and antipyrin also liquefy when triturated with the substances previously named, except camphor and menthol; and lead acetate when mixed with carbolic acid, salicylic acid, chloral hydrate, or sodium phosphate forms a liquid or semi-liquid mass. Such combinations (*e.g.*, camphor or menthol and chloral hydrate) are sometimes employed in therapeutics as paints.

A similar liquefaction occasionally occurs when inorganic powders are mixed. In this case a chemical interaction occurs, and sets free the water of crystallisation, which acts as a solvent. This results when a mixture of ferrous sulphate and sodium carbonate is made, hence the use of the exsiccated salts in preparing Pilula Ferri B.P.

The means available for preventing some forms of physical incompatibility are mentioned later (see *emulsions*, page 126); for the rest a knowledge of the solubility of substances is of the greatest importance.

Chemical Incompatibility

This is of more frequent occurrence. The term is applied to cases where chemical interaction, not intended by the prescriber, results. The best way of avoiding this form of incompatibility is by simple prescribing. An intimate knowledge of chemistry is serviceable, but drugs are often so complex in composition and active principles so intricate in constitution that it is almost impossible, in many cases, to

predict that no interaction will occur between two untried preparations unless some analogous case is known. The most frequent examples of chemical incompatibility, however, are due to an oversight on the part of the prescriber of some simple chemical reaction occurring under somewhat modified conditions. Thus ammonium carbonate and syrup of squill have frequently been prescribed together, with the result that effervescence occurs, and ammonium acetate is formed owing to the free acetic acid in the syrup. To avoid such examples it is imperative that the composition of preparations, within limits, be known, and especially that ingredients likely to interact chemically at ordinary temperatures be noted.

Chemical incompatibility may result from almost any form of chemical interaction. Most usually it arises from simple interchange of ions present (double decomposition), or from more or less complete destruction of one or more of the active ingredients. The former is of greatest importance in the case of inorganic, the latter in the case of organic, drugs. Both changes may occur slowly or rapidly, and may be accompanied by the evolution of gas and by a change in colour. In the case of liquids a precipitate may or may not be formed; if a solid is present it may disappear.

Most cases of chemical incompatibility in mixtures are accompanied by the formation of a precipitate. This does not necessarily lead to serious alteration in the pharmacological action of the mixture, but it frequently does, and often also gives the medicine an unpleasant appearance. It should

be remembered that when two solutions are mixed, if an insoluble compound can be formed it generally will be. This depends on the principle of 'balanced actions,' for an explanation of which the student is referred to a work on physical chemistry. Usually the interaction occurs rapidly, and the precipitate is quickly formed. In some cases it occurs slowly; and these are often of serious import. Thus a mixture containing strychnine sulphate and potassium iodide or bromide may gradually deposit crystals of strychnine iodide or bromide, and a case of death has been reported as having resulted from this cause, the patient taking nearly the whole of the strychnine with the last dose.

The cases in which one or more of the active ingredients of a medicine are destroyed can only be touched upon. Such actions are generally due to oxidation, reduction, or hydrolysis. Even water will hydrolyse some substances (more particularly glucosides) at ordinary temperatures, but the action is usually too slow to be of much importance in prescribing. In the presence of alkalies or acids, however, hydrolysis may occur with fair rapidity. Acids or alkalies may also involve decomposition of an active ingredient by acting on a third substance and producing an oxidising or a reducing agent which attacks the ingredient in question. Oxidising and reducing substances themselves are best prescribed alone in solution unless the prescriber knows what change, if any, is likely to occur when they are combined with other drugs. Their combination in the same medicine, at least, should be avoided. In such cases violent ex-

plosions with fatal results to the dispensers have followed.

Chemical incompatibility may sometimes be prevented or retarded by the addition of syrup, glycerin, or similar viscous substances to the mixture (see page 86). Occasionally a prescription is incompatible when dispensed in one way, and is compatible when dispensed in another. In such cases it is regarded as compatible, and it is generally safe to assume that such a prescription will be dispensed in the proper manner. Rarely incompatibility results independently of both prescriber and dispenser. In this case the fault lies in one or more of the ingredients of the prescription. An unsuspected impurity may be present or one or more products may be of faulty manufacture. An example of the latter class came under the notice of the author some time ago. On mixing a solution of sodium bicarbonate with six different specimens of Liquor Bismuthi et Ammonii Citratis B.P. six different results were obtained.

Owing to the extent of the subject of chemical incompatibility no comprehensive rules can be laid down, but experience has shown that most of the cases fall into one or more of the following groups :

(*a*) The combination of an acid and an alkaline substance or preparation.

Besides the alkali hydroxides, carbonates, and bicarbonates, salts composed of a powerful basic and a weak acidic radical (*e.g.*, borax, sodium phosphate, sodium arsenate, potassium acetate and citrate, soluble sulphides and cyanides,

etc.) are more or less alkaline in solution. Salts composed of a strong acidic and a weak basic radical (*e.g.*, alum, copper sulphate, mercuric chloride, persalts of iron, etc.) give an acid reaction in solution. Attention may also be drawn at this point to the fact that strong acids displace weak acids from salts, and the acid, if only slightly soluble, may be precipitated.

The following preparations of the B.P., besides those obviously alkaline, are alkaline : Liquor Arsenicalis, Liquor Sodii Arsenatis, Liquor Calcis, Liquor Calcis Saccharatus, Liquor Plumbi Subacetatis, Glycerini Plumbi Subacetatis, Liquor Sodæ Chlorinatæ, most liniments, Spiritus Ammoniæ Aromaticus, Spiritus Ammoniæ Fetidus, ammoniated tinctures, Pix Carbonis Præparata.

The following preparations are acid : Aceta, all liquors and scale preparations of iron, Liquor Arsenici Hydrochloricus, Liquor Arsenii et Hydrargyri Iodidi, Liquor Zinci Chloridi, Linimentum Terebinthinæ Aceticum, Linimentum Crotonis, Oleum Cadinum and Pix Liquida, liquid preparations of squill except the tincture, Syrupus Limonis, Syrupus Ferri Phosphatis, Syrupus Ferri Phosphatis cum Quinina et Strychnina, Tinctura Benzoini Composita, Tinctura Camphoræ Composita, tinctures of tannin-yielding drugs, Unguentum Hydrargyri Nitratis, wines. Bismuth subnitrate, iodide of arsenic, and caffeine citrate yield acid solutions in contact with water. Mucilage of acacia, sweet spirit of nitre, amyl nitrite, acetic ether, become acid by keeping.

U.S.P.—The following preparations are alkaline : Fluid extracts of liquorice and of senega, Liquor Potassii Arsenitis, the liniments of lime, of chloroform, of soap and soft soap, and of ammonia, Mistura Rhei et Sodæ, the syrups of lime, of rhubarb, and of senega, and Tinctura Guaiaci Ammoniata.

The following are acid : Fluid extracts of conium, ergot, lobelia, nux vomica, sanguinaria, and squill, the

liquors of ferric salts, Liquor Ammonii Acetatis, Liquor Arsenii et Hydrargyri Iodidi, the syrups of orange, calcium lactophosphate, hypophosphites, ipecacuanha, iodide of iron, rose, and squill, Tinctura Opii Camphorata, Tinctura Benzoini and Tinctura Benzoini Composita, Tinctura Sanguinaria, the tinctures of tannin-containing drugs, and Extractum Colchici.

(*b*) The combination of soluble salts of the heavy metals with preparations of vegetable drugs. The tannin and, to a less extent, other constituents of vegetable drugs form insoluble compounds with heavy metals, and are consequently precipitated.

(*c*) The prescribing of preparations of alkaloids or alkaloid-containing drugs with alkalies, double iodides, and drugs containing tannin (see Incompatibilities of Alkaloids, page 82).

(*d*) The combination of oxidising agents with substances capable of being easily oxidised. Such combinations, if triturated in a pure or concentrated form, are liable to lead to explosions; in a few cases fatal results have followed the operation. No definite rules can be laid down for guidance, since oxidation and reduction are relative terms. One substance may act as an oxidising agent to a second substance and as a reducing agent to a third; or the oxidation or reduction may depend on the concentration, temperature, etc. Speaking generally, great care should be exercised in combining oxidising agents with any other drugs. The following list gives the more important oxidising agents and substances easily oxidised:

Oxidising Agents

Nitric Acid and Nitrates
Chromic Acid, Chromates, and Bichromates
Permanganates
Peroxides
Persulphates
Chlorine and its Oxides
Hypochlorites
Chlorates
Iodine and Bromine
Iodates and Bromates
Arsenates
Silver Oxide
Ferric, mercuric, cupric, etc., salts

Substances easily oxidised

Phosphorus
Hypophosphites
Hydriodic Acid
Sulphur
Sulphides
Sulphites
Hyposulphites
Arsenites
Cyanides
Carbon
Organic matter and many organic compounds (alcohol, glycerin, sugars, pyrogallol, tannic acid, alkaloids, vegetable powders and preparations, etc.)
Ferrous, mercurous, etc., salts

Before taking up the incompatibilities of individual substances, it will be convenient to deal with those common to groups of substances.

Acids.—These combine with metallic oxides, hydroxides, and carbonates to form salts. Strong acids displace weaker acids in salts, and if the weaker acid is but slightly soluble (*e.g.*, salicylic acid) it may be precipitated. Soaps are decomposed by nearly all acids; tartar emetic, bromides, iodides, etc., only by the strong mineral acids. In the case of tartar emetic a basic salt of antimony is precipitated. The bromides and iodides yield

hydrobromic or hydriodic acid, which are of importance because they are easily reduced, yielding free bromine or iodine. The strong mineral acids precipitate the acid tartrate from moderately strong solutions of potassium tartrate, and bismuth citrate from Liquor Bismuthi et Ammonii Citratis. Official preparations giving an acid reaction are mentioned on page 79.

Alkalies form salts with acids. They precipitate salts of the alkaline earths and of heavy metals mostly as hydroxides. Alkali carbonates precipitate them mostly as carbonates. Most alkaloids are precipitated from solutions of their salts. Alkalies decompose chloral hydrate (into chloroform and a formate), salol (into phenol and a salicylate), some alkaloids, glucosides, and esters, but only slowly at ordinary temperatures and in ordinary concentrations. Fixed oils and fats are very slowly hydrolysed and converted into soaps. Calomel is converted into the black oxide of mercury. Official preparations which possess an alkaline reaction are given on page 79. (For ammonium hydroxide and carbonate, see page 89).

Alkaloids (except caffeine, *q.v.*, page 93) —Most alkaloids are very slightly soluble in water, and hence are precipitated when an alkaline solution is added to an aqueous solution of one of their salts. The alkali hydroxides and carbonates are the most powerful; the bicarbonates, ammonium carbonate, and weak alkaline salts are least powerful, and in some cases do not cause appreciable precipitation because the concentration of hydroxyl ions is insufficient. Double iodides precipitate nearly all

alkaloids and their salts. The commonest double iodide occurring in prescriptions is potassio-mercuric iodide (Mayer's alkaloidal reagent), and is produced by prescribing mercuric iodide (or chloride) and potassium iodide in the same mixture. Liquor Arsenii et Hydrargyri Iodidi also precipitates alkaloids from solutions of their salts, but is less sensitive than the foregoing. Iodine solutions, which are often produced when an iodide and an acid preparation are prescribed together, are also powerful precipitants of alkaloids and their salts. Bromides and bromine act in a similar manner to the iodides and iodine, but are less sensitive. Tannic acid precipitates most alkaloids, but it is less powerful than the double iodides. Soluble salts of the heavy metals (*e.g.*, mercuric chloride) often combine with and precipitate alkaloidal salts from solutions. The precipitates in nearly all cases are soluble in alcohol, so that no incompatibility may arise if alcoholic preparations are employed. The iodides, bromides, benzoates, salicylates, and some other salts of alkaloids are often but slightly soluble in water, especially in presence of the corresponding alkali salt, and are consequently precipitated when an alkali iodide, salicylate, etc., is added to a solution of an alkaloidal salt. The precipitate is soluble in alcohol, and may not occur if much alcohol is present in the mixture. Quinine acetate is only slightly soluble, and is liable to be precipitated when an acetate and a cinchona preparation are brought together. Alkaloidal salts often precipitate liquid extract of liquorice.

Alcohol.—Gums, albuminous substances, and

many salts are insoluble in alcohol (page 65), and are consequently precipitated in part when alcohol is added to their aqueous solutions. In some cases the precipitate is slowly redissolved owing to the concentration of alcohol being insufficient to maintain the precipitate. In such cases preliminary dilution of the alcohol will prevent any precipitation, even if the final concentration is the same. Oxidising agents generally decompose it, and may form with it explosive compounds. Strong inorganic acids convert it in part into esters. If added to concentrated solutions of chloral hydrate, chloral alcoholate separates out.

Alcoholic preparations exhibit similar incompatibilities. Many of them contain substances in solution which are insoluble in water, and are consequently precipitated when the preparation is added to water.

Glucosides.—Some glucosides gradually undergo hydrolysis and are decomposed when dissolved in water. Acids or alkalies accelerate the change. Tannic acid and lead acetate precipitate most glucosides from their aqueous solution. Comparatively few are soluble in ether.

Gums and mucilages.—Mucilage of acacia gradually becomes acid on standing and largely loses its viscosity. It then fails to act properly as an emulsifying agent and effervesces with alkaline carbonates. The carbonate may be precipitated as calcium carbonate. Saturated solutions of borax and strong solutions of ferric compounds produce a gelatinous mass if added to undiluted mucilage; diluted solutions are compatible. Lead subacetate, even in

dilute solution, causes a precipitate. Alcohol above 50 per cent. strength precipitates mucilage of acacia.

Mucilage of tragacanth behaves somewhat similarly with alcohol and solutions of lead subacetate and of tannin, but owing to the smaller quantity of soluble gum present it is less sensitive to other agents. Solutions of borax and ferric salts, for example, do not gelatinise it.

Mucilage of starch is precipitated by alcohol, by lead subacetate, and by tannin.

Oils, fixed.—When added to solutions of alkalies fixed oils are very gradually transformed into soap at the points of contact (see page 134). Iodine and bromine combine with most fixed oils. Nitric acid converts the olein of fixed oils, especially on warming, into the isomeric, firmer, and more stable substance elaidin. The presence of water accelerates rancidity.

Oils, volatile.—Large quantities of salts separate the oil from aromatic waters, and even from weak alcoholic solutions. Bromine and iodine form additive products with most volatile oils. Strong oxidising agents decompose them. Ferric chloride solution gives a coloration with many volatile oils. Strong sulphuric acid and strong nitric acid also colour and decompose them.

Resins.—Alkalies unite with most resins to form resin soaps which are generally soluble in water. When triturated with carbolic acid, camphor, salol, and similar substances, resins form liquid or pasty masses. Lime or magnesia, if moistened with water and triturated with copaiba or balsam of Peru or tolu, forms a hard mass.

Salts.—The incompatibilities of salts are due to chemical interaction, usually double decomposition, occasionally oxidation and reduction, or to the presence of media interfering with their solution or proper suspension. Speaking generally, if an insoluble compound can be formed it will be. Thus the attempt to combine soluble borates, phosphates, tannins, etc., with soluble salts of heavy metals will result in a precipitate of a heavy metal borate, phosphate, tannate, etc. Many soluble salts of the heavy metals precipitate albuminous, gelatinous, and mucilaginous solutions, and sometimes alkaloids and other vegetable principles. The solubility of a salt is usually diminished by another substance possessing an ion in common with it. Thus soap is salted out by common salt because the sodium chloride and sodium oleate possess the sodium ion in common. For a similar reason hydrochloric acid precipitates sodium chloride from an aqueous salt solution. This action, however, comparatively rarely plays a part in dispensing. Large quantities of soluble salts often throw out alcohol and ethereal substances from an aqueous solution; even the volatile oil may be separated from aromatic waters.

Acid salts have also to some extent the incompatibilities of acids, and alkaline salts of alkalies.

Sugars are readily oxidised, and consequently should not be ordered with powerful oxidising agents, especially in the form of pills and similar preparations. In solution they often play an important part in preventing or hindering incompatibility, especially the precipitation of the hydroxides or oxides of the alkaline earths and heavy metals.

Tannin. — Tannic acid precipitates albumin, gelatin, some gums, nearly all the alkaloids, some glucosides and neutral principles, and antipyrin from solutions. The alkaloidal tannates are soluble in strong or moderately strong alcohol, and in some organic acids. Potassium hydroxide and carbonate, and to a less extent ammonium hydroxide, form, with tannic acid solutions, a precipitate which is soluble in excess of the alkali, the solution becoming coloured. With lime-water tannic acid forms a bluish white to dark blue precipitate. Some salts (sodium chloride, potassium acetate, calcium chloride, etc.) precipitate tannic acid from strong solutions. With solutions of salts of heavy metals tannates are precipitated, and in some cases the salt is reduced. With ferric salts a dark blue precipitate or solution (ink) is formed, according to the concentration of the salt; with pure ferrous salts a white precipitate, which becomes blue, is formed. The formation of iron tannate is prevented by marked excess of phosphoric acid. With solutions of arsenites or arsenates a dirty white precipitate, which gradually becomes greenish, is produced. Oxidising agents destroy it if in aqueous solution, and if mixed in the dry state an explosion may ensue. An aqueous solution converts iodine into hydriodic acid, and a complex mixture results.

Acaciæ Gummi. — See Gums, page 84.

Acetanilidum forms a soft mass when triturated with carbolic acid, thymol, and many other phenols. Otherwise it is a very stable substance. Strong solutions of caustic alkalies decompose it, forming anilin. With alcoholic solutions of ferric chloride a red coloration is produced.

Acetonum possesses very similar incompatibilities to alcohol (page 83).

Acida.—See page 81. For individual acids see below, and also Nitrates, Salicylates, etc.

Acidum Arseniosum.—See Arsenites.

Acidum Carbolicum coagulates albuminous solutions, gelatin jelly, and collodion. Caustic potash or soda (not the carbonates) converts it into carbolates, which are soluble in water, and the solution darkens in colour from oxidation. It is easily oxidised, the characters of the change varying with the oxidising agent used. Nitric acid converts it into nitro-phenols. Sweet spirit of nitre gives with carbolic acid solutions a yellow, then brownish-red solution, and finally a precipitate (? nitroso-phenol). With dilute ferric chloride solutions it forms a deep violet solution, but the reaction is prevented by acids, some salts, and many organic substances. When rubbed with camphor, chloral hydrate, thymol, and similar substances it forms a liquid or semi-liquid mass.

Acidum Chromicum is a powerful oxidising agent. Its incompatibilities are mainly due to this. With soluble salts of most heavy metals it forms a slightly soluble chromate or dichromate.

Acidum Hydriodicum is a powerful reducing agent. A number of substances decompose it with the liberation of free iodine, which may further act upon the drugs in question. Even exposure to light gradually oxidises it.

Acidum Hypophosphorosum is a powerful reducing agent. See Hypophosphites (page 98).

Acidum Hydrocyanicum Dilutum is readily oxidised by oxidising agents, and with many soluble salts of the heavy metals it forms insoluble cyanides. It decomposes mercurous compounds into mercury and mercuric salts. With iodine solutions it may form the explosive cyanogen iodide. In aqueous solution hydrocyanic acid gradually decomposes into ammonium formate.

The alkaline cyanides are weak salts, and are easily decomposed by acids. They are relatively strongly alkaline, and

consequently may precipitate alkaloids from solutions of their salts.

Acidum Nitrohydrochloricum Dilutum.—The B.P. preparation is a mixture of nitric and hydrochloric acids, and its reactions are those of its constituent acids. The U.S.P. preparation contains free chlorine. It is an oxidising agent.

Acidum Tannicum.—See Tannin, page 87.

Æthylis Carbamas.—See Urethane, page 106.

Alumen.—Alkali hydroxides and carbonates, lime-water, and borax precipitate aluminium hydroxides from alum solutions. Soluble phosphates precipitate aluminium phosphate. Tartaric acid may cause a precipitate of potassium acid tartrate. Alum has also the incompatibilities of sulphates (*q.v.*).

Aluminium sulphate has similar incompatibilities, except that tartaric acid causes no precipitate.

Ammonium Hydroxide and Carbonate.—With mercuric compounds insoluble double compounds are formed; if combined with calomel a black double compound results. Solutions containing free iodine, bromine, or chlorine in excess may form the explosive nitrogen iodide, bromide, or chloride. With phenols coloured solutions are produced on standing. Solutions of chloral hydrate are decomposed into chloroform and chloral ammonia. Other incompatibilities are those of alkalies (*q.v.*), but on account of its much smaller dissociation ammonium hydroxide is less powerful than these.

Ammonii Sales.—Alkalies decompose these, producing free ammonia. The presence of free iodine or chlorine in solutions may produce nitrogen iodide or chloride. Otherwise the incompatibility is mainly that of the acidic radical (anion).

Antimonium Tartaratum (Antimonii et Potassii Tartras U.S.P.).—Mineral acids precipitate a basic salt (and acid potassium tartrate); alkalies and soaps precipitate the oxide from solutions of tartar emetic. With most of the soluble heavy metal salts insoluble tartrates are formed, but mercuric chloride is reduced and precipitated as calomel; silver nitrate is also reduced. A precipitate is formed with solutions of tannin and the vegetable astringents, and with albuminous and mucilaginous solutions. Alcohol throws it out of solution.

Antipyrinum possesses most of the incompatibilities of alkaloids (page 82), but the precipitate obtained with iodine solution is soluble in excess of antipyrin solution, forming a clear liquid. Nitrites and substances containing them (Spiritus Ætheris Nitrosi, Liquor Ethyl Nitritis B.P.) give, with solutions of antipyrin, a green solution which deepens in colour; if the solutions are concentrated, crystals of iso-nitroso-antipyrin may separate. Ferric solutions, if not too acid, form a deep red solution with antipyrin. Syrupus Ferri Iodidi also yields a red liquid with antipyrin, and a precipitate may gradually be deposited. Copper sulphate gives a green solution. When triturated with chloral hydrate, carbolic acid, thymol, resorcin, urethane, or sodium salicylate, a liquid or soft mass results. In the presence of moisture calomel is gradually decomposed by antipyrin, mercury and mercuric chloride being formed; the change is accelerated by the presence of alkalies.

Apomorphinæ Hydrochloridum (*cf.* Alkaloids, page 82). The base, precipitated by alkalies, quickly turns green and darkens further in colour. Nitric acid gives a blood-red colour, a dilute solution of ferric chloride a deep red colour. A solution of the salt gradually becomes green in colour. It acts as a mild reducing agent.

Argenti Nitras.—Alkalies precipitate the oxide or carbonate; chlorides, bromides, iodides, phosphates, borates, arsenites, arsenates, sulphides, citrates, salicylates, and in moderately strong solutions sulphates, precipitate the corresponding silver salts. Tannins produce a precipitate of silver tannate, which is subsequently reduced. Many other organic substances (glucose, volatile oils, etc.) also reduce silver nitrate in solution.

Argenti Oxidum is a powerful oxidising agent and forms explosive mixtures with most substances which are easily oxidised.

Arsenates (Sodii Arsenas) precipitate solutions of salts of the heavy metals as arsenates. Reducing agents convert arsenates into the somewhat more active (pharmacologically) arsenites. Solutions of sodium arsenate are slightly alkaline,

and consequently possess to some extent the incompatibilities of alkalies.

Arsenites [Liquor Arsenicalis B.P. (Liq. Potassii Arsenitis U.S.P.), Liquor Arsenici Hydrochloricus B.P. (Liquor Acidi Arsenosi U.S.P.)] form insoluble arsenites with solutions of salts of the heavy metals and of tannin. Arsenites act as reducing agents. Oxidising agents convert them into arsenates.

Liquor Arsenicalis B.P. and Liquor Potassii Arsenitis U.S.P. are alkaline, and consequently may precipitate alkaloids from solutions of their salts, and also other substances incompatible with alkalies and with carbonates (*e.g.*, lime-water).

Liquor Arsenici Hydrochloricus B.P. and Liquor Acidi Arsenosi U.S.P. are acid and possess the incompatibilities of acids. Owing to the presence of the acid these solutions are compatible with many heavy metal salts.

Arsenii Iodidum dissociates in aqueous solution into arsenious and hydriodic acids, and consequently possesses the incompatibilities of arsenites and iodides. It precipitates many alkaloids from solutions of their salts. Oxidising agents liberate free iodine. Iodine is also gradually given off by the salt itself when exposed to air and light.

Atropina.—See Alkaloids (page 82).

Auri Chloridum precipitates most alkaloids from solutions of their salts, and albumen from albuminous solutions. With solution of potassium iodide, aurous iodide is formed and iodine liberated. It is readily reduced by reducing agents.

Barii Chloridum in solution is precipitated by soluble sulphates, sulphites, phosphates, carbonates, and tartrates, and by tannic acid.

Benzoates (Acidum Benzoicum, Sodii Benzoas) form precipitates with solutions of the salts of most heavy metals; in some cases a precipitate does not form if the solution is markedly acid. Mineral acids precipitate benzoic acid from moderately strong solutions of soluble benzoates. Quinine benzoate is only sparingly soluble (1 in 400), and is consequently precipitated when benzoic acid or a benzoate is added to a moderately strong quinine solution.

Bicarbonates.—See Alkalies and Carbonates. By boiling, solutions of bicarbonates are changed into carbonates.

Bichromates (Potassii Bichromas) are powerful oxidising agents. They precipitate the solution of salts of most heavy metals and also moderately strong solutions of many alkaloidal salts.

Bismuthi Sales.—Of simple salts only the acetate is soluble in water. The subnitrate decomposes on standing in contact with water, nitric acid being liberated; hence the subnitrate is incompatible with carbonates or bicarbonates in aqueous solution. With mucilage of acacia and mucilage of tragacanth it forms flocculent or pasty masses immiscible with water. Iodides in solution are converted into the red oxyiodide, and later into a black iodide; iodine is liberated if much free nitric acid develops. Hypophosphites reduce the subnitrate, forming a black compound.

Bismuth carbonate has no important incompatibilities beyond those of carbonates.

Bismuth (oxy-) salicylate gradually decomposes in contact with water and gives off salicylic acid. Ferric salts consequently give with it a violet colour.

Bismuthi et Ammonii Citras is decomposed by most inorganic and some organic acids, bismuth citrate being precipitated.

Borates.—Boric acid is a weak acid, borax a weak alkali. Solutions of borax precipitate the solutions of salts of most heavy metals as borates or hydroxides, but the precipitate may be soluble in excess of the metallic salt. Strong solutions of borax gelatinise mucilage of acacia. On account of its alkaline reaction, borax precipitates alkaloids from solutions of their salts. The addition of mineral acids to a saturated borax solution causes boric acid to crystallise out.

Bromides (including Acidum Hydrobromicum).—Silver, lead, and mercurous salts in solution are precipitated as bromides; bismuth and antimony salts in solution form insoluble oxybromides. Calomel in the presence of solutions of bromides turns black; mercurous bromide may be regarded as being first formed, but it decomposes into

mercuric bromide and mercury. Some alkaloidal bromides (quinine, strychnine, codeine, etc.) are very slightly soluble, and consequently are precipitated, often slowly, when a soluble bromide is added to a moderately strong solution of a salt of the alkaloid. Oxidising agents liberate free bromine.

Bromoformum is decomposed by exposure to light, free bromine being liberated. Decomposition is accelerated by the presence of alkalies, a bromide and a formate being finally formed.

Butyl-Chloral Hydras possesses similar incompatibilities to chloral hydrate (page 94), but to a relatively less degree. Alkalies decompose it into allylene dichloride in place of chloroform.

Caffeina, unlike other alkaloids, is not precipitated by potassio-mercuric iodide. Owing to its weak basic properties it does not combine with dilute acids to form salts. Concentrated acids form salts with it, but these are dissociated on dilution with water. Alkaline solutions are not much more active than water, and may have less effect on it owing to the formation of double compounds.

Caffeinæ Citras is soluble in three parts of water, but the further addition of water dissociates the compound, and a precipitate of caffeine is formed, which redissolves when sufficient water is added to make a 1 in 32 solution of the dissociated salt.

Calcii Sales.—The sulphate, phosphate, carbonate, tartrate, and hydroxide are very sparingly soluble, and are precipitated from solutions of other calcium salts under favourable conditions. The hydroxide is the most soluble. Its solution (lime-water) becomes turbid on exposure to air, owing to the absorption of carbon dioxide and the formation of the carbonate. With solutions of tannic acid it gives a greyish precipitate, and, owing to its alkalinity, precipitates oxides or hydroxides from solutions of salts of heavy metals and alkaloids from solutions of their salts. The arsenite, borate, and citrate of calcium are also very slightly soluble in water, and may be formed if a soluble arsenite, etc., is added to a solution of a calcium salt.

Calcii Hypophosphis.—See Hypophosphites.

Calx Chlorinata.—*Cf.* Chlorum.

Calx Sulphurata.—*Cf.* Sulphur.

Camphora.—When triturated with chloral hydrate, carbolic acid, thymol, and other phenols, naphthol, salol, menthol, and resinous substances, a liquid or soft mass is produced.

Carbonates are decomposed with effervescence by all the ordinary soluble acids except hydrocyanic acid. Solutions of the alkali carbonates, which are alone soluble, precipitate salts of other metals as carbonates, oxides, or hydroxides. They also precipitate most alkaloids from solutions of their salts.

Bicarbonates produce similar actions but, owing to their much smaller alkalinity, they do not precipitate many alkaloids from solutions of their salts.

Chloral Hydras.—Alkaline solutions decompose chloral hydrate, forming chloroform and a formate. The presence of alcohol and a salt (potassium bromide, etc.) with chloral hydrate in solution may lead to the separation of so-called chloral alcoholate as an oily layer. With impure samples of potassium iodide and bromide a solution of chloral hydrate has given, besides chloroform, free iodine and bromine. Aqueous solutions gradually decompose and become acid. It forms a liquid or pasty mass when triturated with phenols, camphor, menthol, salol, sulphonal, phenacetin, urethane, and some other organic substances.

Butyl-chloral hydrate undergoes similar changes to chlora hydrate.

Chloralamidum is decomposed by alkalies and even by warm water; chloral hydrate and ammonium formate are first formed.

Chlorates are powerful oxidising substances, and form explosive combinations when mixed dry with readily oxidisable bodies (see page 81). In neutral or alkaline solution they are compatible with most substances. Acids decompose them, forming chlorine and oxides of chlorine, or perchlorates.

Chlorides form precipitates with solutions of simple salts of silver and of mercurous salts. Lead chloride is but

sparingly soluble, and is liable to be precipitated under favourable conditions.

Chlorum.—In solution chlorine is a powerful oxidising substance. It liberates iodine and bromine from solutions of iodides or bromides. With alkalies it forms chlorides and chlorates, or hypochlorites. With ammoniacal compounds it is liable to form an explosive compound (nitrogen trichloride). Chlorine solutions gradually change to dilute hydrochloric acid.

Chrysarobinum is partially dissolved by solutions of caustic alkalies with the formation of a brownish-red solution.

Cinchona.—The incompatibilities of this bark are due to the alkaloids (*cf.* page 82) and tannic acid (page 87) it contains.

Citrates of the alkali metals precipitate solutions of salts of most heavy metals, but the precipitate is usually soluble in excess of citrate. Quinine citrate is only sparingly soluble (less than 1 in 800), and is precipitated when a soluble citrate is added to moderately strong solution of a quinine salt.

Cocainæ Sales decompose gradually in aqueous solution, more rapidly in the presence of alkalies or on heating. The hydrochloride decomposes calomel; the mixture becomes grey owing to the formation of uncombined mercury, and the mercuric chloride which is also formed combines with the alkaloid, and an insoluble compound is produced. See also Alkaloids (page 82).

Codeina is moderately soluble in water (1 in 80), and it therefore acts as a moderately powerful base. It is also not precipitated by alkalies from solutions of its salts unless these are concentrated.

Colchicina is hydrolysed by dilute mineral acids and by alkalies to colchiceine and methyl alcohol. Its other incompatibilities are those of alkaloids in general, but, being moderately soluble in water, alkalies do not precipitate the base when added to solutions of its salts. It gradually decomposes on exposure to light.

Copaiba.—With more than one-fifth its weight of slaked lime or magnesia, copaiba forms in the presence of moisture

a hard solid mass. With about 10 per cent. of magnesia, moistened with water, it forms a plastic mass. Shaken with a caustic alkali solution, it is partly converted into a resin soap (see page 85).

Creosotum is readily oxidised by oxidising agents, and may take fire or explode when mixed with them. It gives coloured solutions with solution of perchloride of iron.

Cresolum has somewhat similar incompatibilities to carbolic acid, but in less degree owing to its smaller solubility in water. It does not precipitate solutions of albumin or gelatin, or collodion. With dilute ferric chloride solutions it gives a blue colour. It is generally used in soap solution; such solutions are destroyed by acids, cresol being precipitated.

Creta Præparata.—See Calcium and Carbonates.

Cupri Sulphas.—Caustic alkalies precipitate the hydroxide, carbonates precipitate basic carbonates, from solution of copper sulphate. The precipitate formed by ammonia liquor or ammonium carbonate is soluble in excess, the deep blue solution produced having a solvent effect on cellulose. Soluble iodides when added to copper sulphate solutions precipitate cuprous iodide and liberate free iodine. Arsenites precipitate the green copper arsenite, and phosphates the bluish copper phosphate. Tannic acid is precipitated as a tannate.

Digitalis Folia.—The active principles of digitalis leaves are decomposed by strong acids or alkalies. Tannic acid, some metallic salts (of iron, silver, lead) produce precipitates when added to digitalis solutions.

Diuretin (theobromine sodium salicylate) is a somewhat unstable body. Its solutions are alkaline. On addition of acids, even in small quantities, theobromine is precipitated. Sodium bicarbonate, phosphate, and citrate, and borax, but not caustic alkalies, form a precipitate on standing when added to its solutions. It also possesses the incompatibilities of theobromine and sodium salicylate.

Ergota.—Tannic acid and preparations containing it produce a precipitate in most fluid preparations of ergot.

Ferri Sales.—Alkalies and their carbonates precipitate from solutions of iron salts hydroxides or carbonates, the

latter gradually changing to the hydroxide. Tannic acid and preparations containing it—viz., those of many crude vegetable drugs—form a greenish or bluish black solution or precipitate with solutions of simple salts of iron. Phosphates and borates form precipitates of iron phosphate or borate if added to neutral solutions of iron salts. Sulphides precipitate iron sulphide; and soluble sulphites, arsenites, and chromates precipitate the corresponding iron salt if in neutral or nearly neutral solution.

Ferrous salts are changed to ferric compounds by oxidising agents. Ferric salts may be converted to ferrous by reducing agents; thus hypophosphites added to an acid ferric solution change this to the ferrous form, and are themselves oxidised to phosphates; if the ferric solution is neutral, ferric hypophosphite is precipitated. Iodides, also, if added to an acid ferric solution, reduce this to a ferrous state, and iodine is liberated owing to the hydriodic acid first formed.

Carbolic acid and most other simple aromatic compounds, and volatile oils, resins, and morphine, give coloured solutions with ferric chloride solution. Mucilage is precipitated by a strong ferric chloride solution, but the two are miscible if both are diluted with water.

Formaldehydum is a powerful reducing agent. It coagulates gelatinous and albuminous solutions. Caustic alkali solutions decompose it.

Gelatinum is coagulated by solutions of many salts of heavy metals and by solutions of tannic acid and preparations containing it.

Glycyrrhizinum (and liquid extract of liquorice) is precipitated by acids and by concentrated solutions of many metallic salts and alkaloidal salts.

Guaiaci Resina gives a blue colour with oxidising agents and with mucilage of acacia. With phenolic compounds it forms a liquid or soft mass.

Guaiacolum.—The incompatibilities of guaiacol are the same as those of creosote (page 96).

Hexamethylenamina is unstable in aqueous solution. If warmed with dilute acids it breaks up into formaldehyde

and an ammonium salt. Except alkalies, substances which precipitate alkaloids (tannin, mercuric chloride, etc.) also precipitate this compound.

Hydrargyri Perchloridum (Hydrargyri Chloridum Corrosivum).—Alkalies and their carbonates and borax precipitate from solutions the oxide or oxychlorides; ammonium hydroxide or carbonate precipitates ammoniated mercury. Soluble iodides or bromides cause a precipitate of mercuric iodide or bromide which is readily soluble in excess of the iodide or bromide solution. It precipitates solutions of albumen or gelatin, but the precipitate is soluble in excess of either reagent or in solution of common salt. With tannin it forms an insoluble tannate. A strong solution of mercuric chloride precipitates many alkaloids and other vegetable principles. Reducing agents (arsenites, ferrous salts, tartar emetic, alcohol, etc.) in the presence of water convert it into calomel.

Hydrargyri Subchloridum (Hydrargyri Chloridum Mite). Solutions of alkalies and their carbonates convert calomel into a black mass, usually the black oxide; ammonium hydroxide and carbonate form with it a complex black compound. Iodides, bromides, cyanides, and other reducing agents convert it into mercury and a mercuric compound. Oxidising agents oxidise it to the mercuric state. Exposure to sunlight gradually decomposes calomel; the process is accelerated by the presence of iodoform and other organic substances.

Hypophosphites are powerful reducing agents, especially in acid solutions. Compounds of mercury, silver, or gold are reduced to the metallic state; arsenates to arsenites, and ferric salts to ferrous. Acids form hypophosphorous acid, which is oxidised by the air to phosphorous and phosphoric acids. With oxidising agents hypophosphites are liable to form explosive compounds.

Ichthyolum.—Acids precipitate ichthyol-sulphonic acid. Solutions of iron compounds form an insoluble iron sulpho-ichthyolate. Caustic alkalies liberate ammonia from it, and some alkaloids combine with it to form resinous compounds.

Iodides.—Acids form hydriodic acid, which is oxidised by the air and iodine liberated. Ferric salts, cupric salts, and

oxidising agents liberate iodine. Sweet spirit of nitre, being usually acid, also liberates iodine (see page 286). Soluble salts of mercury, silver, and lead are precipitated as iodides which redissolve in excess of the alkali iodide solution, except mercurous iodide, which is decomposed into mercuric iodide and free mercury, the latter remaining as a precipitate. Calomel is changed to mercurous iodide, which is decomposed in the manner just stated. The double iodide of potassium and mercury precipitates nearly all alkaloids and their salts.

Iodoformum.—Solutions in alcohol, ether, or fixed oils and fats gradually decompose in sunlight, becoming red and then brown owing to the liberation of iodine. Alkalies and substances (silver nitrate, volatile oils, etc.) having an affinity for iodine, decompose it; if triturated with silver nitrate an explosion may result. Mixed with calomel and exposed to daylight, mercuric iodide is gradually formed, the colour of the mixture changing to red. Tannin, in the presence of moisture, deodorises and decomposes iodoform.

Iodum.—Solutions of caustic alkalies and their carbonates dissolve iodine, with the formation of iodide and iodate. With ammonia liquor the brown-coloured explosive compound iodide of nitrogen may be formed; it is more liable to result from mixing alcoholic solutions of iodine (in excess) and ammonia. Oxidising agents (chlorates, etc.) convert it into an iodate; reducing agents (hypophosphites, hyposulphites, sulphites, etc.) transform it to an iodide. Iodine itself acts as an oxidising agent; it converts arsenites to arsenates. It combines directly with mercury to form mercurous and mercuric iodides, and with iron to form ferrous iodide. It forms additive products with many fixed oils and volatile oils, uniting with the latter in some cases—*e.g.*, oil of turpentine—with explosive violence. Starch forms a blue compound with iodine. An alcoholic solution, if warmed with an alkali, forms iodoform. A solution of iodine in potassium iodide solution precipitates nearly all alkaloids.

Liquor Arsenii et Hydrargyri Iodidi precipitates most alkaloids from solutions. Alkalies precipitate oxide of mercury, and silver nitrate silver iodide.

Liquor Plumbi Subacetatis is compatible with relatively few substances. It precipitates alkaloids, gums, and most vegetable principles. It is strongly alkaline, and is consequently incompatible with acids.

Liquor Trinitrini.—See Nitroglycerin.

Lithii Sales.—Soluble carbonates or phosphates precipitate lithium carbonate or phosphate from strong solutions of other lithium salts.

Magnesia forms magnesium salts with acids. It is slightly soluble in water, producing an alkaline solution; with relatively small quantities of water it forms an indiffusible mass. A small quantity combines with a relatively large amount of copaiba and forms a solid mass. It gradually takes up carbon dioxide from the air and becomes converted in part into the carbonate.

Magnesii Sales.—Soluble hydroxides, except ammonium, precipitate magnesium hydroxide; soluble carbonates, magnesium hydroxycarbonate; soluble phosphates, a magnesium phosphate; arsenates, magnesium arsenate; and tartrates, magnesium tartrate—from solutions of magnesium salts. In strong solution magnesium sulphate precipitates albumins and also glycyrrhizin from solutions.

Menthol forms a liquid or semi-liquid mass with carbolic acid, chloral hydrate, camphor, and similar substances.

Morphina has the incompatibilities of other alkaloids (page 82). The base, however, is soluble in excess of caustic potash or soda. It acts as a mild reducing agent, reducing silver nitrate and gold salts, and is readily oxidised by oxidising agents. Sweet spirit of nitre gives a yellow coloration with it. Potassium iodide may cause a white precipitate, and dilute solutions of perchloride of iron, if not too acid, produce a blue coloration.

Mucilagines.—See page 84.

Naphthol, triturated with carbolic acid, camphor, and similar substances, forms a diffluent mass.

Nitrates are powerful oxidising agents, and form explosive combinations with easily oxidisable substances (page 81). In weak solution they possess no noteworthy incompatibilities.

Nitric acid, in the undiluted state, is compatible with relatively few substances; when diluted its incompatibilities are mainly those of acids (page 81).

Nitrites are, in general, compatible with most substances if in alkaline or neutral solution. If acid they act as strong reducing, occasionally oxidising, agents, and are incompatible with easily oxidisable or reducible substances. Sweet spirit of nitre quickly becomes acid by keeping. In this state it liberates iodine from potassium iodide solutions (see page 286). Sweet spirit of nitre and other nitrites if acidified give with phenazone (antipyrin) a bright green colour (isonitroso-antipyrin); with carbolic acid and other phenols and with sodium salicylate, on standing, brownish-red or brown colorations. With solutions of morphine salts a yellow colour is produced. Amyl nitrite decomposes on exposure to light, and becomes acid. The change is markedly accelerated by the presence of water.

Nitroglycerin is a powerfully explosive substance. It is stable in alcoholic solution (Liquor Trinitrini B.P., Spiritus Glycerylis Nitratis U.S.P.). The addition of more than an equal quantity of water causes separation of nitroglycerin, which is not completely redissolved until eight volumes of water have been added. Caustic alkali solutions on warming decompose it, forming a nitrite and various other substances.

Nux Vomica.—See Strychnina.

Olea.—See page 85.

Oleum Terebinthinæ.—If left in contact with water, oil of turpentine is gradually changed into terpin hydrate. See also Olea Volatilia (page 85).

Opium has the incompatibilities of its constituents, chiefly alkaloids (see Morphine, page 100). The resinous and other ingredients rarely produce any effect. Meconic acid gives a red colour with dilute ferric chloride solutions, but the colour is partly masked by the colouring matter of the opium. The tincture when added to saline solutions (*e.g.*, of potassium citrate) forms a brownish flocculent cloud (chiefly resinous matter).

Paregoric (Tinct. Camphor. Co. B.P., Tinct. Opii Camph.

U.S.P.) when added to water, and especially aqueous saline solutions, forms an opalescent mixture owing to the volatile oil and camphor being in part thrown out of solution. These gradually rise to the surface, and an unpleasant looking mixture results. (The addition of glycerin generally improves the mixture.)

Pancreatinum is rendered inert by acids, and consequently is not adapted for administration by the mouth unless properly protected by an efficient pill coating. Heating above 70° C. destroys it. Alcohol in sufficient quantity precipitates it from aqueous solutions.

Paraldehydum is oxidised by oxidising agents. Caustic alkalies form with it an aldehyde resin. It liberates iodine from solutions of iodides.

Permanganates are powerful oxidising agents. They oxidise and are therefore reduced by most organic substances—alcohol, glycerin, tartaric acid, fixed and volatile oils, phenols, etc.—and if triturated with reducing agents often explode with violence. They oxidise mercurous to mercuric salts, ferrous to ferric compounds, arsenites to arsenates, and in slightly acid solution liberate iodine, bromine, or chlorine from iodides, bromides, or chlorides. Even from weak solutions they precipitate aconitine as a permanganate; from stronger solutions of morphine, quinine, caffeine, and some other alkaloids they may also precipitate the alkaloid as a salt.

Phenacetinum forms a liquid when triturated with carbolic acid or chloral hydrate. It is decomposed by strong acids or alkalies.

Phenylis Salicylas.—See Salol.

Phosphates.—The phosphates of the alkaline earths and heavy metals are insoluble in water, and are consequently precipitated when alkali phosphates or phosphoric acid are added to salts of other metals. The precipitate is generally soluble in dilute mineral acids. Sodium phosphate, owing to its alkaline reaction, precipitates alkaloids from solutions of their salts. It also forms a soft mass when triturated with lead acetate, chloral hydrate, or carbolic acid.

Phosphorus is very readily oxidised, even by exposure to air. With powerful oxidising agents, and with sulphur or sulphides, it forms an explosive mixture. If warmed with solutions of caustic alkalies or lime it is decomposed, hypophosphites and phosphoretted hydrogen being formed.

Physostigmina has the incompatibilities of alkaloids (page 82), but on account of the moderate solubility of the base it is less liable than most other alkaloids to be precipitated when alkalies are added to a solution of a salt; the solution, however, becomes red in colour owing to the instability of the base (formation of eseroline and rubeserine).

Picrotoxinum is a reducing agent, and should not be combined with oxidising agents. It is more soluble in alkaline solutions than in water.

Pilocarpina.—The base is readily soluble in water, and consequently is not precipitated when alkalies are added to a solution of a salt. Alkalies, however, decompose it. Otherwise its incompatibilities are the same as those of other alkaloids (page 82).

Plumbi Acetas.—From solutions caustic alkalies precipitate the hydroxide, carbonates a basic carbonate, soluble sulphates, sulphites, phosphates, chromates, iodides, bromides, and in not too dilute solution chlorides, citrates, tartrates, benzoates, and salicylates, precipitate the corresponding compounds of lead. Tannin solutions precipitate lead tannate. Some alkaloids, glucosides, resins, albumins, colouring matters, and other vegetable substances are precipitated by lead acetate. Triturated with sodium phosphate, chloral hydrate, or carbolic acid, it forms a liquid or semi-solid mass.

Potassii Sales.—Tartaric acid or tartrates in acid solution are liable to throw down acid potassium tartrate (solubility 1 in 220), but otherwise these possess no incompatibilities due to the potassium. (See Acetates, Bromides, Carbonates, etc.).

Pyrogallolum is a reducing agent. Its solutions gradually darken owing to oxidation by the air. This occurs very rapidly in presence of alkali, and the solution becomes almost black. Some inorganic salts, especially iron salts, form coloured solutions or precipitates with pyrogallol solutions;

mercury, silver, and gold salts are reduced to the metallic state. If triturated with carbolic acid, camphor, or menthol, a liquid or soft mass results.

Quinina.—Acetates of the alkali metals precipitate quinine acetate when added to solutions of quinine salts. Many other organic salts (citrates, tartrates, benzoates, salicylates) also form precipitates, either quinine or the corresponding quinine salt, when added to a solution of a salt of quinine. Other incompatibilities are those of alkaloids in general (page 82), but iodides and bromides in neutral solution are compatible with quinine salts.

Resorcinum.—Aqueous solutions gradually become brown on exposure; more quickly in the presence of alkalies. Sweet spirit of nitre and dilute solutions of ferric chloride, or chlorinated lime or soda, produce dark red or violet solutions when added to a solution of resorcin. It forms liquid or soft masses when triturated with acetanilide, antipyrin, camphor, or carbolic acid.

Saccharum and **Saccharum Lactis** are readily reduced, and if triturated with powerful oxidising agents may give rise to an explosion. If warmed with dilute acids they are inverted.

Salicinum is gradually hydrolysed by dilute acids.

Salicylates.—Solutions of sodium salicylate gradually turn brownish on standing, especially if alkaline. A dilute ferric chloride solution, if not too acid, gives a bluish or reddish violet coloration with solutions of salicylates; if the ferric chloride is nearly neutral a basic ferric salicylate may be precipitated. Sweet spirit of nitre, when added to solutions of salicylates, gradually produces a reddish-brown coloration. Silver nitrate, lead acetate, and calcium chloride give precipitates (salicylates) with solutions of salicylates; even lime-water becomes turbid on adding a strong solution of a salicylate. Soluble salicylates precipitate quinine salicylate from solutions of quinine salts or of cinchona preparations. Most acids when added to sodium salicylate precipitate salicylic acid.

Salol.—If warmed with alkalies Salol is decomposed into carbolic acid (or a carbolate) and a salicylate. A liquid or

semi-solid mass results if it is triturated with camphor, chloral hydrate, or carbolic acid.

Santoninum is soluble in solutions of caustic alkalies (it is best dissolved in alcohol first), forming red-coloured solutions of so-called santoninates. Such solutions are precipitated by soluble salts of lead, iron, and copper, and by tannin; mineral acids reprecipitate santonin.

Sapones.—Owing to their alkaline action soaps possess for the most part the incompatibilities of alkalies (page 82). Acids decompose their solutions, and the fatty acid is liberated. Salts of the alkaline earths and heavy metals decompose soap solutions and form insoluble soaps.

Spiritus Ætheris Nitrosi.—See Nitrites, page 101.

Spiritus Ammoniæ Aromaticus.—The incompatibilities of aromatic spirit of ammonia are mainly those of ammonium hydroxide, ammonium carbonate, and alcohol. On adding to water, opalescence results owing to precipitation of the volatile oils.

Spiritus Glycerylis Nitratis U.S.P.—See Nitroglycerin.

Strychnina possesses the incompatibilities of alkaloids in general (page 82). It is very slightly soluble in water (1 in 7,000), and is liable to be precipitated when even weak alkalies or alkaline salts are added to solutions of its salts. Strychnine iodide is also but slightly soluble in water, and may gradually crystallise out when a soluble iodide is added to a solution of a strychnine salt. Strychnine bromide is more soluble than the iodide, but it may be deposited when a solution of a bromide and a strychnine salt are allowed to stand.

Sulphates precipitate solutions of calcium, strontium, barium, or lead salts, owing to the insolubility of the sulphates of these metals. Silver sulphate is relatively slightly soluble (1 in 130), and might be precipitated under favourable conditions.

Strong sulphuric acid decomposes most inorganic and organic compounds; the latter are frequently charred.

Sulphides.—The soluble sulphides are reducing agents. They are weak salts, and are readily decomposed by acids.

Their solutions have an alkaline reaction. Soluble salts of the heavy metals precipitate them, forming insoluble heavy metal sulphides.

Sulphites of most metals, except alkali metals, are insoluble or but slightly soluble, and are precipitated when an alkali sulphite is added to a neutral solution of a salt of another metal. These metallic sulphites are soluble in dilute mineral acids, sulphurous acid being formed. Sulphites in acid solution (*i.e.*, sulphurous acid) act as powerful reducing agents. The alkali sulphites usually contain sulphate, and official sulphurous acid always contains sulphuric acid.

Sulphonal forms a soft mass when triturated with chloral hydrate.

Sulphur is a reducing agent, and trituration with powerful oxidising agents is liable to lead to an explosion. When warmed with solutions of hydroxides it forms soluble sulphides and thiosulphates.

Suprarenal preparations gradually decompose in aqueous solution. They are more quickly destroyed by alkalies and by oxidising agents.

Tartrates.—The acid tartrates of potassium (cream of tartar) and of ammonium are relatively slightly soluble, and are consequently thrown down when acid is added to potassium tartrate or ammonium tartrate, or when a soluble tartrate is added to a potassium or ammonium salt in acid solution. Alkali tartrates when added to neutral solutions of the salts of most other metals form insoluble tartrates. Solutions of tartarated antimony are precipitated by tannin. Tartrates may act as reducing agents; they convert mercuric chloride into calomel.

Terebenum.—*Cf.* Oleum Terebinthinæ.

Theobromina reacts similarly to caffeine (*q.v.*).

Thymol possesses similar incompatibilities to, but is less active than, carbolic acid (page 88). It forms a semi-liquid mass when triturated with carbolic acid.

Urethanum is decomposed by caustic alkalies. It forms a liquid or semi-liquid mass when triturated with chloral hydrate or carbolic acid, and with camphor, menthol, salicylic

acid, salol, antipyrin, and other similar compounds, if the weather is hot.

Urotropinum.—See Hexamethylenamina.

Valerianates.—Many acids decompose valerianates and cause the precipitation of valerianic acid.

Vina.—Wines have principally the incompatibilities of alcohol. They usually contain organic acids and often tannic acid.

Zinci Sales.—Soluble hydroxides, carbonates, phosphates, borates, arsenates, tartrates, sulphides, cyanides, form precipitates when added to solutions of zinc salts. Tannic acid may be thrown out as zinc tannate.

FLAVOURING, COLOURING, AND PERFUMING AGENTS

Flavouring Agents.—It has been said that too little attention is given by medical men to the gentle art of making medicines pleasant, and although this may not be universally true, there can be little doubt that many practitioners subscribe to the popular belief that the more unpleasant the medicine the more efficacious it is. Bitters are the panacea of these men. They are introduced into nearly all prescriptions for mixtures, whether these are for children or for adults, for acute or for chronic disease. This is a mistake. Bitters have a fairly definite pharmacological action and therapeutic use, which should be understood; they should not be employed as flavouring agents indiscriminately.

In deciding upon a flavouring agent for any patient the personal factor should be kept in mind. Individuals vary in taste considerably, and what is palatable for one may be decidedly unpalatable for another. Speaking broadly, children and women prefer sweet flavours, men (especially smokers) bitter and warm aromatic flavours. Most children also like acid preparations, but abhor bitter things. It is questionable, indeed, if bitters as such are of the slightest value in the treatment of children.

In many cases nauseous medicines can be administered in cachet, capsule, or pill, and the need of a flavouring agent be avoided. Occasionally an active drug occurs in two or more forms (salts) of different solubilities, the least soluble being sufficiently insoluble in water to make it the most preferable when large quantities of the active drug have to be administered. Again, apart from flavouring agents, the unpleasant taste of a drug may be diminished by increasing the viscosity of its solution by means of a colloidal substance. Or instead of ordering flavouring agents in a medicine, directions may be given for the medicine to be taken in wine, coffee, etc., or for the mouth to be washed out immediately before and after administration with an aromatic water or mouth wash. Drugs which paralyse the sense of taste have no practical importance.

To enumerate all the substances that are or might be used as flavouring agents is beyond the scope of this work. Nor is it possible to do more than refer to the necessity of blending tastes harmoniously to obtain palatable results. Tincture of orange and warm aromatic waters go well with bitters, most fruit syrups with acid solutions, essence of bitter almonds with emulsions, and so on. In many cases a judicious combination of flavouring agents is better than any one alone, but this requires experience.

The flavouring agents in common use are:

Essential oils.—Of these there is large variety, with widely different flavours. Many are official, and the more important are represented also by

spirits (essences) and waters. Cinnamon is generally useful, but does not go very well with an acid or pure saline taste. Peppermint is generally much better for the latter. Caraway, cloves, coriander, nutmeg, and pimento are allied to cinnamon, but are less delicate. Aniseed is usually associated with cough medicines and generally goes well with the members of this class. Oil of bitter almonds (or benzaldehyde) and vanillin are suitable for emulsions. Infusion of coffee, the aroma of which is due to a volatile oil, is a flavouring agent of wide applicability; it is least useful for saline tastes.

Fruit essences and syrups.—Fruit essences are synthetic substances (mostly acetates, butyrates, etc., of ethyl, amyl, etc.) largely used in confectionery, but little in medicine. If employed they should be used sparingly and in the form of syrups. They are best adapted for imparting a flavour to medicines with no markedly distinctive taste. The same is true of natural fruit syrups. These are often colouring agents also, but can only be used with neutral or acid solutions. Syrupus Cerasi (cherry), Syrupus Rubi Idæi (raspberry), Syrupus Fragariæ (strawberry), and others can be obtained.

Infusions of dried fruits (prunes, tamarinds, etc.) are of greater service. The acidity of most of these should be remembered.

Alcohol is rarely used solely as a flavouring agent, although it improves the taste of most mixtures. It may be employed as flavouring tinctures (orange, cardamoms, etc.) or as wines, spirits, or even liqueurs. The adventitious substances in these

liquids sometimes play an important part; creosote, for example, is better taken in rum than in other alcoholic liquids.

Chloroform is a sweetening agent. It should not be used in stronger solution than the official water unless its general pharmacological action is required. It has a clean characteristic sweet taste with no after-taste, and is of general utility.

Sugar is the substance mainly employed for sweetening mixtures. Owing to its increasing the viscosity of the liquid, some of the mixture is liable to remain as a coating on the buccal and pharyngeal mucous membranes, and the taste may thus be prolonged. Partly on this account it is not adapted for powerfully bitter medicines, although in virtue of its viscosity it diminishes the intensity of the taste of these. Weak sugar solutions are liable to ferment, and may thereby impair the keeping properties of medicines; and it should not be forgotten that to some persons sugar is distasteful. Other objections have been brought against sugar, but notwithstanding all these it must be conceded that it is the most useful flavouring agent we possess. For mixtures it is generally used in the form of syrup, and of this a fairly liberal proportion should be allowed. A number of flavouring syrups are official, and many others can be obtained.

Honey and *glycerin* for flavouring purposes may be regarded as syrups with a slight distinctive taste. Diluted glycerin does not ferment like diluted syrup or honey, and for some purposes it is to be preferred. Its taste, however, is the least pleasant of the three.

Saccharin (glusidum B.P., benzosulphinidum U.S.P.) and its allies may be used as sweetening agents when sugar is contra-indicated. They are stable synthetic products, and are very much (200 to 500 times) sweeter than sugar. Their taste is distinct from that of sugar and differs to some extent with each compound.

Liquorice, in the form of the extract or fluid extract, is an admirable drug for covering unpleasant tastes. Its flavour is curiously persistent, and it is especially useful as a flavouring agent for children's mixtures. It covers well both bitter and saline tastes, but its corrective action is limited, and sometimes relatively large quantities must be used. It is incompatible with acids owing to the insoluble glycyrrhizic acid being thrown out; and strong solutions of some inorganic and alkaloidal salts also cause a precipitate to form.

Chocolate is a useful flavouring agent for substances which are being administered as powders or as lozenges.

Carbonic acid. — Aëration of a solution is a valuable means of correcting unpleasant tastes. This may be done most easily by prescribing an effervescing mixture (page 122) or a granulated effervescing powder (page 170). A slight excess of acid makes the medicine more palatable.

Acids, in virtue of their clean taste and the reflex salivation they induce, are sometimes used for flavouring purposes. They are most useful for medicines which remain for some time in the mouth (lozenges, confections). Citric and tartaric acids or cream of tartar are generally employed.

Bitters, when not too strong, prove very palatable to many people. A pure bitter should be associated with an aromatic substance, and it is often improved by the presence of sugar and colloidal matter. A bitter is often more agreeable when combined with an acid.

Colouring agents.—These are employed (i.) to give a distinctive colour to certain preparations (*e.g.*, medicated lint, solutions of toxic substances), (ii.) to produce a medicine of pleasant appearance, (iii.) occasionally to impress the patient, (iv.) in the case of external applications to produce a skin colour.

For the first purpose there is an abundance of dyes and colours. The better-known aniline dyes (methylene blue, methyl violet, fuchsin, etc.) are suitable for solutions, and the common pigments (lampblack, coloured earths) for powders to be used externally. For medicines to be taken internally vegetable or animal colouring matters, which are less toxic, are preferred. Many of these give solutions of pleasing appearance, but in the case of some the colour is different in neutral, acid, and alkaline solutions. The more important colouring preparations and the colours they produce in acid and alkaline solutions are given on page 114.

For producing brown colours in liquid medicines burnt sugar (caramel) is generally used.

Fixed oils and fats can be coloured red by alkannin (from Radix Alcannæ) and Sudan III., yellow by annatto, and green by a specially prepared chlorophyll (chlorophyllum in adipe solubile).

	Reaction of Solution	
	Acid	Alkaline
Tinctura Cocci . .	bright red	maroon red
,, Croci . .	lemon yellow	orange
,, Lavandulæ Co. (coloured with red sanders wood)	bright red	dirty dark red
Decoctum Hæmatoxyli .	bright red	violet
Syrupus Cerasi . .	bright red	olive green
,, Rhœados . .	red	brown green
,, Rubi Idæi .	bright red	green violet
,, Violarum . .	red	green

To obtain a skin colour for applications to the face various substances have been used (Armenian bole, Terra ochrea, and mixtures of white, yellow, and red powders), but iron peroxide (1 per cent.) is the best single colouring agent to employ for white or yellowish-white powders. Jewellers' rouge, Venetian red, Indian red, burnt sienna give a similar colour. Calamine with white powders makes a good skin colour, but unfortunately the colour of calamine varies considerably. Carmine alone is too bright a red to make it generally useful for skin applications. It is well adapted, however, for colouring applications for the lips.

Perfuming agents.—These are too well known to need description, and it is only necessary to remind students of the advantage of using such agents when prescribing powders, lotions, and similar external applications. They are comparatively rarely required to cover the unpleasant smell of an active ingredient. Iodoform is the substance which

has given most trouble in this way, and for this coumarin is perhaps the best perfuming agent. Smells, like tastes, should be harmonised to obtain the best results.

The following are some of the more important perfuming preparations: Oils of rose, lavender, orange-flower (oleum neroli), wintergreen, bergamot, rosemary, and other volatile oils; certain synthetic substances—heliotropin, nerolin—used in perfumery, and perfumes (violets, Eau de Cologne, etc.) themselves; coumarin, Tonka bean, musk, sumbul, and castoreum. All these may be used for powders, and most of them for ointments. For lotions, rose water, and orange-flower water are chiefly employed.

THE FORMS OF MEDICINES

Medicines may be administered or applied in a variety of ways. The form which the medicine will take depends mainly on (*a*) the position of the disease, whether of accessible or inaccessible organs, (*b*) the pathological condition of the diseased part, (*c*) the rapidity of action desired, (*d*) the taste or requirements of the patient, (*e*) the properties of the drug.

(*a*) Although it is often necessary to administer medicines internally for diseases of the skin and other accessible tissues, the treatment mainly adopted for these is a local one. Forms of medication, such as lotions, ointments, plasters, which allow of the remedy or remedies being applied directly to the diseased part, are used. When the diseased organ is not directly accessible it is generally influenced through the blood. The remedy or remedies must therefore be given in such a form and way as will allow of absorption into the blood, as far as possible, without injuriously affecting the organ or tissue concerned in the absorption.

(*b*) The pathological condition has occasionally a modifying influence on the form in which remedies are administered. Thus in acute inflammations of the skin lotions are generally preferable to oint-

ments or similar preparations, while in chronic diseases of the skin the reverse is frequently the case.

(*c*) The rapidity of action desired also frequently modifies the form and manner in which a drug is given. If the action of morphine is required quickly, a solution of a salt of morphine is injected under the skin; if a slower and more prolonged action is desired, the morphine is given as a suppository introduced into the rectum, or as an opium preparation by the mouth.

(*d*) The tastes and requirements of patients not infrequently affect the form in which a drug is prescribed. Nauseous medicines have often to be given in the form of capsules, cachets, or pills; and for the convenience of travellers and men at business it is occasionally necessary to prescribe drugs in as portable a form as possible.

(*e*) The properties of drugs themselves sometimes prohibit or allow of certain forms of administration. Deliquescent substances cannot be conveniently dispensed as powders, nor is it advisable to administer irritant substances by hypodermic injection; on the other hand, volatile compounds may be given by inhalation.

It will be convenient to consider first those fluid forms of medicines which are of most general applicability.

Misturæ

Mixtures are fluid forms of medicines adapted without further treatment for internal administration by the mouth. They may consist of a mixture

of miscible or immiscible fluids, or of a solution of soluble or a suspension of insoluble solids. Thus almost any drug can be prescribed in this form. The vehicle is nearly always water, distilled or medicated (aromatic waters, infusions, etc.), rarely glycerin, oils, or other media. Water possesses the advantages of being practically without action on the alimentary canal and of being miscible with its secretions, thus facilitating the local action and the absorption of drugs. It possesses the disadvantages of bulk and of facilitating the interaction of substances in solution; occasionally it causes hydrolysis.

The various remedies which may be prescribed in this form may be divided into (i.) those which are soluble in water (miscible liquids and soluble solids) and (ii.) those which are insoluble in water.

Substances soluble in water (*Solutiones*).—These include all liquids, solids, or gases, whatever their solubility may be, which the prescriber intends shall be administered in solution. Very powerful drugs, although their solubility may be small, belong to this group if their solubility is more than sufficient to produce the desired therapeutic effect. The chief difficulty in prescribing drugs of this class—apart from the difficulties of combination, which are dealt with under Incompatibility—is the question of solubility. Speaking generally, care should be taken to ensure the complete solution of the drug at any temperature to which it is likely to be subjected.

A prescription such as the following, which was given for a child, should not be written:

℞

Potassii Chloratis	ʒj
Aquæ	℥iss

Ft. sol.

Sig. ʒj tert. qq. hor. sum.

As the solubility of potassium chlorate is only 1 in 16 at ordinary temperatures, about one-quarter of the salt in the above prescription remains undissolved. The excess is readily soluble in warm water, but it comes down in large crystals on cooling. If the prescriber were inaccessible, a dispenser, in making up the prescription, would probably reduce the potassium chlorate to powder and put a 'shake the bottle' label on the bottle. Unfortunately this does not always overcome the difficulty. If the temperature of the room vary, as it is almost sure to do, a portion of the salt crystallises out when the temperature falls; when the temperature rises some of the powder goes into solution and more of the salt crystallises out when the temperature again falls; and thus after a few days the powder is liable to be converted into a crystalline residue. The medicine is thereby rendered less pleasant to take, and for diseases of the mouth or throat less efficacious. The crystallisation may also alarm the nurse or patient, and on that account such prescriptions should be avoided.

Apart from the question of solubility (*cf.* page 60), these substances, which include most preparations of the Pharmacopœia, offer little difficulty in prescribing. Incompatibility must be kept in mind and avoided (page 73), and the value of flavouring agents should not be forgotten (page 108).

Examples

℞

Tincturæ Digitalis . . .		ʒiss	6 Cc.
Aquam	ad	℥vj	ad 200 Cc.

Ft. mist.

Sig. 'One tablespoonful to be taken every four hours.'

℞

Liq. Arsen. et Hydrarg. Iod.		ʒj	3 Cc.
Spiritus Chloroformi .	.	ʒij	6 Cc.
Aquam . . .	ad	℥viij	ad 200 Cc.

Ft. mist.

Sig. 'One tablespoonful to be taken three times a day, after meals.'

℞

Ferri et Quininæ Cit. .	.	gr. v	0·35 Gm.
Tincturæ Nucis Vomicæ	.	♏v	0·3 Cc.
Aquam Chloroformi	ad	℥ss	ad 15·0 Cc.

Ft. mist. Mitte ℥vj (150 Cc.).

Sig. 'One tablespoonful to be taken in water three times a day, half an hour after food.'

℞

Potassii Citratis . .	.	gr. xv	1·0 Gm.
Tincturæ Hyoscyami .	.	♏xv	1·0 Cc.
Tincturæ Aurantii .	.	♏x	0·6 Cc.
Infusum Buchu . .	ad	℥j	ad 30·0 Cc.

Ft. mist. Mitte ℥xij (400 Cc.).

Sig. 'Two tablespoonfuls to be taken three times a day, between meals.'

℞

Ammonii Carbonatis .	.	gr. iv	0·25 Gm.
Tincturæ Scillæ . .	.	♏x	0·6 Cc.
Syrupi Tolutani . .	.	ʒj	3·5 Cc.
Infusum Senegæ .	ad	℥j	ad 30·0 Cc.

Ft. mist. Mitte ℥viij (300 Cc.).

Sig. 'Two tablespoonfuls to be taken every three hours.'

℞

Calcii Chloridi . .	.	ʒij	8 Gm.
Tinct. Aurantii . .	.	ʒvj	25 Cc.
Syrupi	.	℥iss	50 Cc.
Glycerini . . .	.	℥j	30 Cc.
Aq. Cinnamomi . .	ad	℥vj	ad 200 Cc.

Ft. mist.

Sig. 'One tablespoonful to be taken three times a day.'

℞

Ammonii Bromidi . .		gr. xv	1·0 Gm.
Spiritus Ammoniæ Arom. .		♏x	0·6 Cc.
Extracti Glycyrrhizæ Liq. .		♏x	0·6 Cc.
Aquam Chloroformi .	ad	ʒij	ad 8·0 Cc.

Ft. mist. Mitte ℥vj (200 Cc.).

Sig. 'Two teaspoonfuls to be taken in water three times a day, after meals.'

℞

Sodii Salicylatis . . .		ʒiv	18 Gm.
Tincturæ Aurantii . .		℥ss	17 Cc.
Aquam . . .	ad	℥vj	ad 200 Cc.

Ft. mist.

Sig. 'One tablespoonful to be taken every three hours.'

℞

Quininæ Sulphatis . .		gr. iv	0·25 Gm.
Acidi Sulphurici Diluti .		♏vj	0·3 Cc.
Tinct. Cardamomi Co. .		℥ss	15·0 Cc.
Aquam . . .	ad	℥viij	ad 200·0 Cc.

Ft. mist.

Sig. 'One tablespoonful to be taken three times a day, before food.'

[This mixture is evidently intended to act mainly as a bitter, hence solution of the quinine sulphate is ensured by the addition of a little dilute sulphuric acid.]

℞

Tinct. Ferri Perchloridi .		ʒij	6·5 Cc.
Liq. Ammonii Acetatis .		℥iij	75·0 Cc.
Glycerini		℥ij	50·0 Cc.
Aquam . . .	ad	℥vj	ad 150·0 Cc.

Ft. mist.

Sig. 'A dessertspoonful to be sipped after each meal.'

[A solution of acetate of iron, which is milder and pleasanter than a solution of the chloride, is required; and presumably it is intended to act mainly on the fauces and pharynx.]

℞

Acidi Salicylici . . .		ʒij	7·0 Gm.
Sodii Bicarbonatis . .		ʒiss	5·5 Gm.
Aquæ Menthæ Pip. . .		℥viij	200·0 Cc.

Ft. mist.

Sig. 'Two tablespoonfuls to be taken every three hours.'

[The prescriber evidently intends to give sodium salicylate in an aërated solution.]

℞

Sodii Bicarbonatis . .		ʒiij	11 Gm.
Aquæ		℥viij	200 Cc.

Ft. sol.

Sig. 'The alkaline mixture.'

℞

Acidi Citrici		ʒiiss	9 Gm.
Syrupi		℥j	30 Cc.
Aquam . . .	ad	℥iv	100 Cc.

Ft. sol.

Sig. 'The acid mixture.'

'One tablespoonful to be added to two tablespoonfuls of the alkaline mixture, and the whole drunk whilst effervescing.'

Substances insoluble in water.—Although no sharp line of division can be drawn, it is convenient to divide this group into two classes—viz., (i.) solid substances, excluding resins, insoluble in water, and (ii.) liquids, semi-liquids, and resins immiscible with water.

Insoluble solids include all substances which are not sufficiently soluble in an aqueous menstruum to enable them to be given in solution. In dispensing they are generally rubbed up into a thin paste with a small portion of the menstruum, and the remainder of the menstruum is subsequently added, the bottle being labelled with a 'shake the

bottle' label. The question for the prescriber to consider is what menstruum is best adapted for keeping the powder in suspension for a sufficient length of time after the bottle is shaken to permit of a proper proportionate dose being taken. Light powders generally offer no difficulty, as they remain diffused even in distilled water sufficiently long after shaking. A few light substances of a somewhat unctuous character, such as salol, are preferably triturated in the first place with syrup or glycerin instead of water, as a finer subdivision of the powder is thereby produced, and it is advisable to include some such agent in the prescription. The difficulty of uniform suspension is greatest, however, with heavy powders. These tend to subside rapidly, and unless some suspending agent is added or care taken in the administration it may happen that a smaller dose than that intended will be taken at the commencement, and a larger dose towards the end of the bottle. Of the suspending agents in common use tragacanth holds the premier place; from $1\frac{1}{2}$ to 2 grains to each ounce of mixture is sufficient for all purposes. Gum acacia is less powerful as a suspending agent, but this notwithstanding is frequently used. About 40 grains ($1\frac{1}{2}$ fluid drachms of mucilage) to each ounce of mixture is necessary for heavy powders. Sugar and glycerin, which are also employed, must be used in large quantity to be of much service.

Unfortunately these various suspending agents are not compatible with all heavy powders. Bismuth subnitrate, for example, forms with mucilage of acacia a mass which settles to the bottom of the

bottle, and which after standing twenty-four hours cannot be dislodged even on violent shaking. With mucilage of tragacanth flaky masses are produced. This substance is therefore best prescribed without the addition of any mucilage. Syrups or glycerin may be used if desired, but must be employed in large quantity; 20 per cent. glycerin or syrup in water has no greater suspending power for bismuth subnitrate than distilled water.

Examples

℞

Magnesiæ		gr. x	0·65 Gm.
Magnesii Sulphatis . .		gr. LX	4·0 Gm.
Spiritus Chloroformi . .		♏x	0·6 Cc.
Aquam Menth. Pip. .	ad	℥j	ad 30·0 Cc.

Ft. mist. Mitte ℥vj (150 Cc.).

Sig. 'Two tablespoonfuls to be taken three times a day, an hour before meals.'

℞

Rhei Radicis . . .		gr. XL	3 Gm.
Sodii Bicarbonatis . .		ʒss	2 Gm.
Spiritus Ammoniæ Arom. .		ʒj	4 Cc.
Syrupi Aurantii . . .		℥ss	15 Cc.
Aquam . . .	ad	℥ij	ad 60 Cc.

Ft. mist.

Sig. 'One teaspoonful to be taken three times a day, before meals.'

℞

Bismuthi Carbonatis . .		℥ss	16·0 Gm.
Sodii Bicarbonatis . .		ʒiij	12·0 Gm.
Tragacanthæ . . .		gr. x	0·6 Gm.
Glycerini		ʒvj	25·0 Cc.
Aq.	ad	℥vj	ad 200·0 Cc.

Ft. mist.

Sig. 'One tablespoonful to be taken three times a day, a quarter of an hour before meals.'

℞

Bismuthi Subnitratis .	. gr. xx	1·3	Gm.
Acidi Hydrocyanici Dil.	. ♏iij	0·15	Cc.
Morphinæ Hydrochloridi	. gr. $\frac{1}{6}$	0·012	Gm.
Glycerini	. ʒss	2·0	Cc.
Aquam . . .	ad ʒj	ad 4·0	Cc.

Ft. mist. Mitte ℥ij (60 Cc.).

Sig. 'One teaspoonful to be taken before each meal.'

℞

Pulveris Cretæ Arom. .	. gr. xx	1·3 Gm.
Aquæ Cinnamomi .	. ʒij	8·0 Cc.

Ft. mist. Mitte ℥ij (60 Cc.).

Sig. 'Two teaspoonfuls to be taken morning and evening.'

℞

Quininæ Sulphatis .	. ʒj	4 Gm.
Syrupi Aurantii . .	. ℥j	30 Cc.
Glycerini	. ℥j	30 Cc.
Aquam . . .	ad ℥vj	ad 200 Cc.

Ft. mist.

Sig. 'Two tablespoonfuls to be taken four hours before an attack is expected.'

℞

Saloli	. gr. x	0·65 Gm.
Tinct. Aurantii . .	. ♏x	0·6 Cc.
Syrupi	. ʒj	4·0 Cc.
Aquam Cinnamomi .	ad ℥ss	ad 15·0 Cc.

Ft. mist. Mitte ℥viij (200 Cc.).

Sig. 'One tablespoonful to be taken two hours after each meal.'

℞

Sulphonal. . . .	. ʒij	8 Gm.
Syrupi Zingiberis .	. ʒvj	25 Cc.
Spiritus Chloroformi .	. ʒiss	6 Cc.
Mucilaginis Acaciæ .	. ℥j	30 Cc.
Aquam . . .	ad ℥vj	ad 200 Cc.

Ft. mist.

Sig. 'Two tablespoonfuls to be taken every other night, two hours before retiring.'

Solids and liquids immiscible with water include for the most part fixed oils and fats, volatile oils, oleo-resins and resins, but any substance immiscible with water to the required extent belongs to this group. The question to solve is whether such substances can be made into an apparently uniform mixture which will suffice for administration.

If a fixed oil and water are violently shaken together, a whitish mixture is produced which quickly separates into its two component parts on standing. If, however, a viscous substance miscible with water, such as mucilage of acacia, is added and the shaking repeated, a mixture is produced which is much more permanent. On examining such a mixture under a low power of a microscope it will be seen to consist of oil globules suspended in the aqueous menstruum; and if further experiments are made it will be found that the permanency of the mixture depends mainly upon the fineness of the oil globules and the viscosity of the aqueous medium. The finer the oil globules, the smaller is the viscosity of the medium required. Such a mixture is known as an emulsion.

Emulsiones

An emulsion may be defined as a mixture consisting of an oily or resinous substance separated into fine globules or particles by means of a so-called emulsifying agent. The mixture has usually a milky-white appearance.

Emulsifying agents may be divided into three classes—(i.) colloidal substances soluble in water—

e.g., mucilaginous, albuminous, and gelatinous substances; (ii.) alkalies; (iii.) saponins and the preparations of vegetable drugs (soap-bark, senega, etc.) containing them. Natural emulsions (see next page), which might be regarded as a fourth group, belong to the first.

The theory of emulsification.—This is ill-understood. The process appears to depend largely upon the relative densities of the emulsifying and emulsified substances and upon the friction which occurs between the particles or globules of emulsified substance and the emulsifying agent. The latter is dependent upon the size of the particles or globules and the viscosity of the emulsifying agent. In all probability surface tension, film formation, and possibly other factors also play a part.

For practical purposes, however, the question resolves itself mainly into differences in density between the emulsifying and emulsified substances, the viscosity of the emulsifying agent, and the fineness of the particles or globules of emulsified substance. If two immiscible liquids of exactly the same specific gravity are shaken together, an emulsion will be produced which will remain permanent so long as the two liquids retain the same density; and, *ceteris paribus*, liquids nearer in density to the emulsifying agent are more easily emulsified and form a more permanent emulsion than those more removed from it. Emulsions consisting of media of equal density are practically impossible, and to overcome difference in density the phenomenon of friction is employed—the viscosity of the emulsifying agent is increased. The viscosity necessary depends upon the density and the size of the globules of emulsified substance, and the time it is desired to keep the emulsion. The smaller the globules and the nearer the density to that of the emulsifying agent, the less the viscosity needed; the longer the time it is desired to keep the emulsion, the greater is the viscosity required. (Unless the viscosity is large the friction introduced by it is gradually overcome by gravity.) If the viscosity is insufficient,

separation into a dense and a very thin emulsion occurs. Uniformity can again be obtained by shaking, but separation occurs more quickly than on the first occasion.

The different classes of emulsifying agents vary in their mode of action, and, in so far as this is of importance, it will be described under each agent.

Natural emulsions.—Certain substances occurring in nature are emulsions. Of these milk and yolk of egg are of most importance. Other natural substances yield emulsions when rubbed up with water, and these may be divided into (i.) exudations (the gum-resins); (ii.) oily seeds. The characteristic feature which distinguishes a gum-resin from other resinous products is this ability to form an emulsion when triturated with water. This is due to the fact that the exudation consists of particles of gum and resin intimately mixed, and when water is added a mucilage is formed with the gum which suspends the fine particles of resin. If oily seeds are rubbed with water, the fatty particles which are in a state of fine division are suspended by the albuminous solution formed by the action of water on the proteids of the seeds. Gum-resins, however, are not good emulsifying agents, as, with few exceptions, the quantity of gum in them is not more than is sufficient for the complete emulsification of the resin and volatile oil; indeed, when prescribed alone the addition of a little gum acacia is generally advisable.

Substances inimical to emulsification.—For the most part these are substances which precipitate or interact chemically with the emulsifying agent (*cf.* incompatibilities of mucilages, page 84; alkalies,

page 82). Acids are the most powerful, but acid salts and soluble metallic salts generally are inimical; the salts of the alkali metals are, speaking generally, best borne. Alcohol, if present to the extent of 40 per cent. or more, is incompatible with most emulsions; 25 per cent. or less is compatible, provided that alcohol has no marked solvent action on the emulsified substance,[1] and even increases the permanency of the emulsion. Glycerin and syrup are said to be inimical to emulsification, but in the writer's hands the reverse has been the case: emulsions containing 25 per cent. of either substance have been more permanent, although less white in appearance, than emulsions of the same strength made without them.

Emulsifying agents.—The emulsifying agents in common use are gum acacia and tragacanth and their mucilages, alkalies, soap, saponin and tincture of quillaia, extract of malt, and the natural emulsions. Various others (gelatin, Iceland moss, mucilages of elm and of sassafras pith, dextrine, plasmon, casein, pancreatin) have been employed, but, from a prescriber's point of view, they are of little importance. With the exception of the last two they may be used to increase the viscosity and thereby the permanence of an emulsion, but they possess no distinct advantages over tragacanth.

The point to be aimed at in prescribing emulsions is to order a sufficient quantity of emulsifying

[1] Moderate quantities of alcohol destroy castor oil emulsions, owing to the miscibility of this oil with alcohol.

agent to emulsify the substance and keep it in suspension for the requisite time.

Gum acacia.—This is the best all-round emulsifying agent. It possesses practically no taste or obvious pharmacological action, it produces a finer and whiter emulsion than most other emulsifying agents, it keeps well, and it is almost of universal application.

For fixed oils (*e.g.*, cod liver oil) good proportions to use are—oil 1, gum acacia ¼, water 1. Glycerin or syrup, or both, may be substituted for a portion of the water. An emulsion made with these proportions will remain apparently unchanged for a week, and afterwards it separates but slightly. With twice the quantity of water the emulsion is also moderately permanent, but with more water than this separation occurs fairly rapidly. With four parts or more of water a half part of gum acacia should be used.

Volatile oils, oleo-resins, chloroform, and similar substances require a larger proportion of gum for their emulsification. It is difficult to lay down definite proportions for these owing to differences in density, dose, etc., but generally the quantity of gum should not be less than that of active ingredient, and should not fall below one-sixth that of the water employed.

Resinous tinctures are usually emulsified with mucilage of acacia (see page 268). About one-twelfth as much mucilage as aqueous menstruum is required.

Tragacanth is a good suspending agent, but is not a good emulsifying agent. The oil globules

in an emulsion are relatively large, and unless the emulsion is very viscous separation readily occurs. Emulsions made with this substance have usually a somewhat translucent appearance. It is best adapted for limpid volatile substances, as the emulsion can be made in a bottle (page 264) and loss from evaporation during emulsification is thereby reduced to a minimum. About 4 grains of tragacanth to the ounce of emulsion is required. It is also useful for emulsifying and suspending resins (*e.g.*, guaiacum resin) and resinous tinctures, but a combination of gum acacia and tragacanth gives better results. If it is desired to increase the viscosity of emulsions made with other emulsifying agents, tragacanth (1 to 2 grains to the ounce of emulsion) may be added to the prescription.

Mucilage of tragacanth may be employed in place of mucilage of acacia for emulsifying oils, but it is much inferior and must be used in larger quantities.

Compound tragacanth powder may also be used in place of tragacanth alone. It possesses, however, no decided advantage over this; the starch present is useless, and the gum acacia is insufficient to be of much service. The quantity required is three times that of tragacanth.

Yolk of egg is a valuable emulsifying agent, and is too little used in prescribing. It is of general applicability, and it will bear the presence of substances inimical to emulsification almost better than any other emulsifying agent. Unfortunately, emulsions made with it do not keep well unless some preservative is present, but they keep sufficiently

long for the needs of medical practitioners. One yolk will make 3 to 4 ounces (90 to 120 Cc.) of emulsion. Useful proportions are—fixed oil 1 fl. ounce (or volatile oil $\frac{1}{2}$ fl. ounce), yolk of egg 1, water 2 fl. ounces.

Owing to the difference in colour of yolks of eggs, an emulsion may vary slightly in colour from time to time. Yolks of fresh eggs should be used: they make a better and pleasanter emulsion than those of so-called cooking eggs.

Milk is not a good emulsifying agent. The albuminous solution which suspends the fatty particles of the milk is already diluted beyond the requisite strength for a permanent emulsion, hence the formation of cream, and any further addition of oil tends to accelerate rather than retard the separation. It may be used in conjunction with other emulsifying agents if desired, but it possesses no advantages worthy of consideration, and its liability to turn sour is a serious disadvantage.

Condensed milk (lac concentratum), on the other hand, is a powerful emulsifying agent, and emulsions made with it keep much better than those made with fresh milk. One part of sweetened condensed milk with 5 parts of water will emulsify 30 parts of cod liver oil. This, however, is near the limits of its power, and in practice a larger proportion of condensed milk should be used—*e.g.*, condensed milk 1, water 3, fatty oil 15. The following proportions—condensed milk 1, water 1, fatty oil 10—produce an emulsion of semi-solid consistence. This emulsifying agent might be useful where economy is necessary, as in public dispensaries, etc.

Plasmon and similar albuminous substances may be used as emulsifying agents in the proportions recommended for gum acacia. The emulsions produced are not so fine, nor do they keep so well, as those obtained with gum acacia, but their value as foods is greater. Casein has been used as an emulsifying agent, but it possesses no obvious advantages over the cruder products.

Gelatin has been recommended for emulsifying some substances. It is, however, an inferior emulsifying agent, and is unnecessary.

Oily seeds as emulsifying agents are much less used in this country than on the Continent. They are not very powerful emulsifiers, and the emulsions prepared with them do not keep well, but they are generally pleasant to take, and also possess a certain food value. Sweet almonds, blanched, are almost invariably used, occasionally with the addition of bitter almonds (5 per cent.) as a flavouring agent. The addition of a little gum acacia is advisable. The following proportions may be employed—sweet almonds 1, gum acacia $\frac{1}{4}$, fatty oil 2, water 6; or compound almond powder (B.P.) may be used—compound almond powder $1\frac{1}{2}$, fatty oil 2, water 6. As in other emulsions, glycerin or syrup may replace part of the water. A simple almond mixture (Mistura Amygdalæ B.P., Emulsum Amygdalæ U.S.P.) and also other 'seed emulsions' are often prescribed without any addition of fatty oil.

Extract of Malt is almost solely used for emulsifying cod-liver oil. Equal parts of extract and oil make a useful emulsion, but larger quantities of oil may be incorporated if desired. As, however the

extract of malt is a valuable food, there is no reason to push its emulsifying power to its limits. It acts solely in virtue of its viscosity. If salts are introduced into the prescription, the addition of a little water to ensure their solution is advisable. Emulsions made with extract of malt keep well.

Alkalies are useful emulsifying agents for external applications, but are of doubtful value for substances to be administered by the mouth. They may be employed to emulsify fatty oils and resins—they are useless for volatile oils—but they only act if free acid is present; in other words, they only emulsify those substances with which they are able to form soaps. Most commercial fixed oils contain a small amount of fatty acid, and when shaken with a solution of caustic alkali a soap is formed with this, and the oil is broken up into very fine globules, which remain suspended and form an emulsion. Fixed oils freed from fatty acids cannot be emulsified with an alkali solution at ordinary temperatures.[1] A considerable excess of alkali is required for emulsification, hence the emulsion contains free alkali as well as a small quantity of soap, both of which may be undesirable for internal medication. It is difficult to lay down in intelligible terms the best proportion of alkali to use with oils or resins, but as a guide 1 part of Liquor Potassæ to 8 parts of fixed oil or 2 parts of resin or oleo-resin may be given. In the writer's opinion, alkalies, except for liniments, are

[1] Slight hydrolysis occurs at normal temperatures when fixed oils are left in contact with solutions of caustic alkalies, but the action is much too slow to be of any practical value.

best avoided as emulsifying agents, unless the effect of an alkali is also desired.

Soaps are powerful emulsifying agents, but they are only of use for external applications. Soft soap is the most convenient and best soap to use, and it is chiefly employed to emulsify volatile oils (especially oil of turpentine) and similar substances. The following proportions give a satisfactory emulsion: Soft soap 1, water 4, volatile oil 10. A larger proportion of fixed oil may be emulsified, but soft soap can rarely be required for this purpose.

Saponins.—Commercial saponins are rarely if ever used by prescribers as emulsifying agents. If an emulsifier of this type is required, tincture of quillaia or tincture of senega is usually employed. The manner in which emulsification is effected by saponins is difficult to understand. It is usually attributed to their power of reducing surface tension; but whatever their action may be it is of wide application. A solution of saponin will emulsify any immiscible liquid on being shaken with it, and it will bear the presence of substances inimical to other emulsifying agents almost with impunity. The acrid taste and irritant action of the saponins, however, largely limit their use for internal administration. Unless an expectorant action—the saponins are attributed with this effect—is desired they are better avoided. They are of greater use for external applications, and especially for emulsifying tars and similar products. The following proportions will be found to give serviceable emulsions: Tincture of quillaia 1,

fixed oil 5, water 1 (or fixed oil 10, water 2); tincture of quillaia 1, volatile oil, chloroform, etc. 5, water 10. For tarry preparations four times the quantity of tincture of quillaia should be used; the amount of water is almost immaterial.

Wool-fat (Adeps Lanæ) will emulsify six times its weight of fixed oil. The following proportions—wool-fat 1, fixed oil 4, water 12—make a serviceable emulsion, which may be used externally as a protective or as an excipient for more powerful remedies.

Glycerin and *syrups* are of little use as emulsifying agents, except for resinous tinctures; and even for these a large proportion of glycerin or syrup—one sixth to one-fourth the quantity of mixture—is required.

Extract of liquorice has been recommended as an emulsifying agent, but it is inefficient. It is of greater service as a flavouring agent.

Choice of emulsifying agent.—From what has been said it will be evident that the choice of an emulsifying agent depends not only on the substance or substances to be emulsified, but also on the use to which they are to be put, especially whether they are for internal or for external application. Examples are given later (page 138), but the following suggestions are made:

For fixed oils (internal administration)—yolk of egg or gum acacia.

For fixed oils (external use)—alkalies or wool-fat.

For volatile oils (internal administration)—gum acacia with tragacanth, or tragacanth alone.

For volatile oils (external use)—soft soap or resin cerate (U.S.P.).

For chloroform and allied substances (internal administration)—tragacanth.

For resins (internal administration)—tragacanth, or gum acacia with tragacanth.

For resinous tinctures—mucilage of acacia, syrup, or glycerin.

For copaiba (internal administration) — gum acacia.

For liquid extract (oleo-resin) of male fern—yolk of egg or gum acacia.

For tars (external use)—tincture of quillaia.

It is perhaps necessary to add that a proper proportion of water is almost as necessary for a good emulsion as a true proportion of emulsifying agent.

The value and use of emulsions.—The form of emulsion not only permits us to obtain uniform distribution in an aqueous medium of a substance immiscible with water, but it also modifies to some extent the action of the active ingredient. Mucilaginous, albuminous, and gelatinous emulsifying agents, in virtue of their colloidal nature, diminish the irritant action of irritant substances and the nauseous taste of nauseous substances, and it has been shown that the fine particles of an emulsified fixed oil undergo hydrolysis in the stomach while oil in bulk remains almost unchanged. The latter action is obviously an advantage in some cases (*e.g.*, cod-liver oil), but a doubtful advantage in

others (*e.g.*, castor oil). As regards other emulsifying agents, more especially alkalies and saponin preparations, the irritant action and nauseous taste of emulsifiable drugs are increased rather than diminished by them; therefore, unless their pharmacological action is desired, they are better avoided for internal use.

The property of substances which necessitates their emulsification is immiscibility with water, and there can be little doubt that if such drugs are intended to be absorbed, an emulsion is the best form in which to administer them. If, however, the dose is sufficiently small, the drug may be given with almost equal efficacy in a gelatin capsule (page 200).

Substances soluble in oils and insoluble or but slightly soluble in water (*e.g.*, camphor, phosphorus, chloroform, salol, etc.) may be prescribed in solution in oil as an emulsion. The emulsifying agent should be that best adapted for and in proportion to the oil present. Volatile oils mixed with fixed oils form better emulsions (with gum acacia) than volatile oils alone. Emulsions for internal administration should generally be sweetened, and the addition of a flavouring agent (Tolu, vanilla, almond, coffee) is often advisable.

Examples

℞

Olei Morrhuæ . . .	.	℥iv	100 Cc.
Acaciæ Gummi . .	.	℥j	25 Cc.
Syrupi	.	℥j	25 Cc.
Aquam Cinnamomi .	ad	℥viij	ad 200 Cc.

Ft. emulsio.

Sig. 'One tablespoonful to be taken after every meal.'

℞

Olei Morrhuæ		℥ij	50·0 Cc.
Creosoti		♏xxiv	1·3 Cc.
Vitellos Ovorum . . .		ij	2
Glycerini		℥j	25·0 Cc.
Aquam . . .	ad	℥vj	ad 150·0 Cc.

Ft. emulsio.

Sig. 'One tablespoonful to be taken three times a day, after meals.'

℞

Olei Morrhuæ		℥vj	150 Cc.
Calcii Hypophosph. . .		ʒiss	5 Gm.
Extracti Malti . . .		℥vj	150 Gm.

Ft. emulsio.

Sig. 'A dessertspoonful to be taken after each meal.'

℞

Saloli		ʒiss	6 Gm.
Olei Amygdalæ . . .		℥ij	60 Cc.
Mucilag. Acaciæ . .		ʒvj	25 Cc.
Syrupi Aurantii . . .		℥iss	50 Cc.
Aquam Cinnamomi .	ad	℥vj	ad 200 Cc.

Ft. emulsio.

Sig. 'One tablespoonful to be taken three times a day, after meals.'

℞

Ammoniaci		ʒij	8 Gm.
Syrupi		℥j	30 Cc.
Aq. Menth. Pip. . .	ad	℥viij	ad 250 Cc.

Ft. mist.

Sig. 'One tablespoonful to be taken three times a day, between meals.'

℞

Asafetidæ		ʒij	8 Gm.
Syrupi Aurantii . . .		℥j	30 Cc.
Aquam Pimentæ .	ad	℥vj	ad 200 Cc.

Ft. mist.

Sig. 'One tablespoonful to be taken an hour after each principal meal.'

℞

Amygdalæ Dulcis	℥j		30·0 Gm.
Amygdalæ Amaræ	ʒss		2·0 Gm.
Acaciæ Gummi	ʒj		4·0 Gm.
Olei Amygdalæ	℥ss		15·0 Cc.
Creosoti	♏x		0·6 Cc.
Syrupi Codeinæ	℥ij		60·0 Cc.
Aquam	ad ℥viij	ad	250·0 Cc.

Ft mist.

Sig. 'One tablespoonful to be taken three times a day, after meals.'

℞

Resinæ Guaiaci	ʒij		8·0 Gm.
Acaciæ Gummi	ʒij		8·0 Gm.
Tragacanthæ	gr. x		0·65 Gm.
Syrupi	℥j		30·0 Cc.
Olei Gaultheriæ	♏xv		1·0 Cc.
Aquam	ad ℥viij	ad	250·0 Cc.

Ft. mist.

Sig. 'One tablespoonful to be taken three times a day, after food.'

℞

Olei Terebinthinæ	♏lxxx		5·0 Cc.
Tragacanthæ	gr. x		0·65 Gm.
Syrupi Aurantii	℥j		30·0 Cc.
Aquam Chloroformi	ad ℥iv	ad	120·0 Cc.

Ft. mist. Mitte statim.

Sig. 'One tablespoonful to be taken every half hour.'

℞

Olei Santali	℥ss		15 Cc.
Olei Amygdalæ	℥iss		45 Cc.
Acaciæ Gummi	ʒvj		25 Gm.
Syrupi	℥iss		45 Cc.
Aq. Cinnamomi	ad ℥vj	ad	200 Cc.

Ft. emulsio.

Sig. 'One tablespoonful to be taken three times a day, after food.'

℞

Copaibæ	.	♏xv	1 Cc.
Mucilag. Acaciæ .	.	ʒss	2 Cc.
Syrupi	.	ʒiss	6 Cc.
Aq. Pimentæ . .	ad	℥ss	ad 15 Cc.

Ft. mist. Mitte ℥vj (200 Cc.).

Sig. 'One tablespoonful to be taken three times a day, after meals.'

℞

Tincturæ Tolutanæ .	.	ʒij	7·0 Cc.
Tincturæ Scillæ . .	.	ʒj	3·5 Cc.
Syrupi Tolutani .	.	℥ij	60·0 Cc.
Mucilag. Acaciæ .	.	℥j	30·0 Cc.
Aquam Camphoræ .	ad	℥viij	ad 200·0 Cc.

Ft. mist.

Sig. 'One tablespoonful to be taken three times a day, between meals.'

ELIXIRIA—HAUSTUS—GUTTÆ

Elixirs are sweet palatable mixtures generally of syrupy consistence. They often contain a considerable proportion of alcohol and are sweetened and flavoured with glycerin, sugar, saccharin, flavouring syrups, liquorice, and volatile oils. The United States Pharmacopœia contains two simple elixirs which may be used as excipients—*Elixir Aromaticum*, consisting of compound spirit of orange 1·2 Cc., syrup 37·5 Cc., alcohol 23·8 Cc., and distilled water to make 100 Cc. (*i.e.*, it contains about 25 per cent. alcohol and 37·5 per cent. syrup); and *Elixir Adjuvans*, consisting of 88 Cc. of aromatic elixir and 12 Cc. of fluid extract of liquorice.

Examples

℞

Tinct. Opii		♏iij	0·2 Cc.
Tinct. Belladonnæ . .		♏iij	0·2 Cc.
Vini Ipecacuanhæ . .		♏xx	1·2 Cc.
Syrupum Aurantii .	ad	ʒj	ad 4·0 Cc.

Ft. mist. Mitte ℥iss (40 Cc.).

Sig. 'One teaspoonful to be taken every four hours.'

℞

Ferri et Quin. Cit. . .		ʒj	4·0 Gm.
Strychninæ Hydroch. .		gr. ss	0·035 Gm.
Spir. Chloroformi . .		ʒj	4·0 Cc.
Spir. Cinnamomi . .		♏xx	1·0 Cc.
Tinct. Aurantii . . .		℥ss	15·0 Cc.
Syrupi		℥ij	60·0 Cc.
Aq. Aurant. Flor. .	ad	℥iv	ad 120·0 Cc.

Ft. mist.

Sig. 'Two teaspoonfuls to be taken three times a day.'

℞

Ext. Cascaræ Liq. . .		ʒj	35·0 Cc.
Ext. Glycyrrhizæ Liq. .		ʒiij	13·0 Cc.
Spir. Cinnamomi . .		♏x	0·8 Cc.
Glycerini		℥ss	18·0 Cc.
Syrupum Aurantii .	ad	℥iij	ad 100·0 Cc.

Ft. mist.

Sig. 'Two teaspoonfuls to be taken every evening.'

℞

Syrupi Sennæ . . .		℥j	30·0 Cc.
Syrupi Rhei . . .		℥j	30·0 Cc.
Spir. Anisi		♏xx	1·2 Cc.
Spir. Cinnamomi . .		♏x	0·6 Cc.
Glycerini		℥ss	15·0 Cc.
Aquam	ad	℥iv	ad 120·0 Cc.

Ft. mist.

Sig. 'Two teaspoonfuls to be taken morning and evening.'

Draughts are merely mixtures intended to be taken at one dose. They may be solutions or emulsions, and are prescribed like these. A draught does not usually exceed two fluid ounces or 50 Cc. in bulk.

Examples

℞

Chloral. Hydratis				
Potassii Bromidi .	āā	gr. x	āā	0·65 Gm.
Syrupi Tolutani . . .		ʒiij		10·0 Cc.
Aquam Chloroformi .	ad	℥j	ad	30·0 Cc.

Ft. haustus.

Sig. 'To be taken at bedtime.'

℞

Paraldehydi		ʒj	4 Cc.
Tinct. Aurantii . . .		ʒj	4 Cc.
Aq. Chloroformi . .	ad	℥iss	ad 50 Cc.

Ft. haustus.

Sig. 'To be taken at bedtime.'

℞

Olei Ricini	ʒiij	10 Cc.
Mucilag. Acaciæ . . .	ʒij	6 Cc.
Syrup. Aurantii . . .	ʒiij	10 Cc.
Aq. Cinnamomi . . .	℥ss	14 Cc.

Ft. haust.

Sig. 'To be taken at bedtime.'

℞

Extract. Filicis Liq. . .		ʒiss	6 Gm.
[Oleo-resinæ Aspidii U.S.P.]			
Vitelli Ovi		ʒij	8 Gm.
Spir. Vini Gallici . .		ʒiss	6 Cc.
Sacchari		ʒij	8 Gm.
Aq. Cinnamomi . .	ad	℥iss	ad 50 Cc.

Ft. haust.

Sig. 'To be taken early in the morning.'

Drops is a term applied to solutions of drugs administered by drops. They are usually concentrated solutions which are diluted at the time of taking or administered on a lump of sugar, but may be relatively weak solutions for dropping into the eye (eye-drops) or ear (ear-drops). The former are prescribed in this way for the convenience of the patient (in travelling, etc.) or because water decomposes (hydrolyses) the medicine. Most of the official liquid preparations can be given in this way if desired.

Examples

℞
Tinct. Strophanthi . . ʒij 10 Cc.
Sig. 'Five drops to be taken in water every four hours.'
Mitte tubulum stillaticium.

℞
Spiritus Camphoræ . . ℥ss 15 Cc.
Sig. 'Ten drops to be taken on a lump of sugar when required.'

℞
Spir. Ætheris Nitrosi . . ℥iss 50 Cc.
Sig. 'Twenty drops to be taken in water every two hours.'

℞
Tinctura Opii . . . ʒj 4 Cc.
Vini Ipecacuanhæ . . ʒvss 20 Cc.
Spir. Chloroformi . . ʒss 2 Cc.
Spir. Cinnamomi . . ʒj 4 Cc.
Ft. guttæ.
Sig. 'Ten drops to be taken in water every three hours.'

℞
Atropinæ Sulphatis . . . gr. j 0·07 Gm.
Cocainæ Hydrochlor. . . gr. v 0·35 Gm.
Aquæ . . . . . . ℥j 30·0 Cc.
Ft. gtt. pro oculo. Dentur in phiala stillaticia.
Sig. 'One drop to be applied night and morning.'

℞

Argenti Nitratis .	. .	gr. j	0·07 Gm.
Aquæ Destillatæ .	. .	℥j	30·0 Cc.

Ft. guttæ pro oculo. Pone in vitrum fuscum.

Sig. 'To be applied three times a day.'

℞

Liq. Hydrogen. Peroxid.	.	℥ss.	15 Cc.

Sig. 'Five drops to be applied to each ear thrice a day, as directed.'

℞

Cocainæ	. . . .	ʒss	2 Gm.
Olei Amygdalæ .	. .	℥j	30 Cc.

Ft. guttæ pro auribus.

Sig. 'To be applied frequently.'

Injectiones Hypodermicæ

Hypodermic injections are liquid preparations for injection under the skin. They are almost invariably aqueous solutions; suspensions in water and oily solutions or suspensions are used in the treatment of syphilis, especially in the Services, but for general practice they cannot be recommended (*cf* page 41). The liquid should be sterile, and aqueous solutions should be as near isotonic with the lymph as possible. As most of the drugs given in this way are powerfully active and exert very little osmotic pressure in the strengths in which they can be given, it is sufficient to prescribe them in 0·85 per cent. sodium chloride solution.[1] The

[1] It is impossible to give any simple rule for accurately estimating the osmotic pressure of a solution from its constituents, but for dilute solutions it may be calculated roughly, but often with sufficient accuracy for therapeutic

dose should not, if possible, exceed 15 minims (1 Cc.).

Most commonly these injections are prepared at the bedside from small tablets, discs, etc., containing the medicament, which are supplied by various manufacturing firms. The discs are directed to be dissolved in sterile or recently boiled and cooled water, but the solution thus prepared is hypotonic. The discs would be much improved if the proper amount of common salt were added to make an isotonic solution. Preparations for hypodermic injection which cannot be prepared in tablet form are usually sold in small hermetically-sealed glass vessels, known as ampoules.

purposes, from molecular quantities by the following coefficients:

Non-ionised compounds (mostly organic) are represented by 2

In ionisable compounds (salts, acids) the acidic and basic radicals (anion and kation) are considered separately.

Each acid radical, or anion (Cl, SO_4, etc.), is represented by 2

Each atom of alkali metal (Na, K) is represented by 1

Each atom of other metals and each organic kation is represented by 0

Thus the coefficient of sugar is 2; of KNO_3 $(1+2=)$ 3; of Na_2SO_4 $(2+2=)$ 4; of $MgCl_2$ $(0+2\times 2=)$ 4; of cocaine hydrochloride $(0+2=)$ 2 ($2\frac{1}{2}$ would be better, the alkaloidal kation being better calculated as $\frac{1}{2}$). To take one of the least favourable examples, the percentage of cane sugar required to give the same osmotic pressure as 0·9 per cent. sodium chloride would be calculated as follows. The coefficient of sugar is 2; of NaCl is 3—*i.e.*, a molecule of sugar exerts $\frac{2}{3}$ the osmotic pressure of a molecule of NaCl. Therefore

$$0{\cdot}9 \times \frac{342 \text{ (mol. wt. sugar)}}{58{\cdot}5 \text{ (mol. wt. NaCl)}} \times \frac{2}{3} = 7{\cdot}9 \text{ per cent.}$$

The percentage required determined cryoscopically is 9·9 per cent.

If the injection is to be prepared by a retail pharmacist, directions should be given that it be sterilised, or, if the drug decomposes when its solution is boiled, that it be prepared with sterilised water and dispensed in a sterile bottle. The bottle should be somewhat squat in shape, and is best closed by means of a sterilised rubber cap, through which the hypodermic needle can be pushed. If the prescriber have any fear that sufficient aseptic precautions will not be taken, the addition of an antiseptic substance (0·5 per cent. phenol or lysol) is advisable.

The principles which should govern this mode of administration have been considered (page 39). It is only necessary to mention the drugs most frequently given in this way. These are: morphine salts (tartrate, sulphate, or for strong solutions and large doses the acetate), hydrochloride of cocaine and its substitutes (eucaine, tropacocaine, etc.), apomorphine hydrochloride, atropine sulphate, hyoscine (scopolamine) hydrobromide, pilocarpine nitrate, strychnine hydrochloride, and ether. Sera and usually vaccines are also administered in this way. Preparations of ergot, of mercury, and of quinine adapted for this mode of administration are injected deeply into muscle (page 45).

GARGARISMATA

Gargles are aqueous solutions which are employed to affect the posterior parts of the mouth by the process known as gargling. This consists of allowing the expired air to pass through the liquid held in the mouth while the head is thrown back.

The gargle thus applied does not reach beyond the anterior pillars of the fauces or the anterior surfaces of enlarged tonsils, but a small quantity is usually swallowed, and there can be little doubt that this mode of application is of service in inflammations around the tonsils when other methods are not permitted. Poisonous doses of drugs should not be prescribed as gargles, as the gargle is often swallowed.

The substances most commonly employed are antiseptic or astringent—boric acid (4 per cent.), borax (4 per cent.), carbolic acid ($\frac{1}{2}$ to 1 per cent.), Liquor Sodæ Chlorinatæ (4 per cent.), Liquor Hydrogenii Peroxidi (10 to 20 per cent.), potassium permanganate ($\frac{1}{10}$ to $\frac{1}{2}$ per cent.), potassium chlorate (4 per cent.), alum (2 to 4 per cent.), ferric preparations (chloride or acetate), tannic acid (2 to 4 per cent.), and infusions of tannin-yielding drugs. Common salt (5 to 10 per cent.) is occasionally used, and at various spas the natural saline water is gargled.

Glycerin is a useful addition to most gargles. It increases the viscosity of the liquid, and in many cases aids the solution of the active ingredient.

For swabbing the back of the throat in chronic inflammation much stronger solutions may be used. The glycerina of the Pharmacopœia, for example, are generally used undiluted.

Examples

℞

Glycer. Boracis . . .	℥ij	50·0 Cc.
Tinct. Myrrhæ . . .	ʒj	3·5 Cc.
Aquam . . .	ad ℥viij	ad 200·0 Cc.

Ft. gargarisma.

Sig. 'To be gargled every two hours.'

℞

Tinct. Ferri Perchlor.	.	℥ss	20 Cc.
Liq. Ammon. Acet.	.	℥iij	120 Cc.
Glycerini . . .	.	℥j	40 Cc.
Aquam . . .	ad	℥vj	ad 250 Cc.
Ft. gargar.			

Sig. 'The gargle to be used after each meal.'

Lotiones

Lotions are aqueous solutions or mixtures employed, without friction, for external application. They are usually applied on lint. Their prescribing rarely offers any difficulty, the principles involved being essentially those which guide the prescribing of mixtures. They should be dispensed in coloured bottles of a shape distinct from those generally used for mixtures for internal administration.

The substances most commonly employed as lotions, grouped according to their principal action, are—

Antiseptic Lotions.—Boric acid (3 per cent.), carbolic acid (1 to 4 per cent.), salicylic acid (0·1 to 0·2 per cent.), sulphurous acid (diluted 2 to 5 times), hydrogen peroxide solution (5 to 10 per cent.), mercuric chloride, etc. (0·5 to 2 per mille), sodium sulphite and hyposulphite (10 per cent.), formalin (0·2 to 1 per cent.), thymol (0·1 per cent.), lysol (1 to 5 per cent.).

Astringent Lotions.—Alum or aluminium acetate (2 to 5 per cent.), strong lead subacetate solution (2 to 5 per cent.), lime-water (diluted or not), zinc sulphate, acetate, chloride, or sulpho-

carbolate (0·5 to 1 per cent.), picric acid (0·5 per cent.).

Stimulating Lotions.—Tar preparations—*e.g.*, Liquor Picis Carbonis (1 to 4 per cent.); cantharides preparations—*e.g.*, acetum (1 to 4 per cent.); salicylic acid (1 to 2 per mille), sulphur (1 to 5 per cent.).

Evaporating Lotions.—A dilute alcohol (5 to 20 per cent.) is generally used.

Alkaline Lotions.—Sodium bicarbonate (1 to 5 per cent.), sodium or potassium carbonate (0·5 to 3 per cent.), borax (1 to 4 per cent.).

Sedative Lotions (other than those included in the above groups).—Dilute hydrocyanic acid (1 to 3 per cent.), basic bismuth compounds (ca. 5 per cent.), zinc oxide or carbonate (ca. 5 per cent.).

Glycerin (about 5 per cent.) is a useful addition to most lotions containing insoluble powders; it produces a smoother lotion. Alcohol has a similar effect. Mucilages should generally be avoided, especially in lotions for the face, as they produce an unpleasant feeling of tightness after evaporation. An almond mixture is less objectionable. Lotions for the face containing insoluble powders should as far as possible be made of skin colour. This may generally be effected by the addition of ferric peroxide (1 per cent.). They may also with advantage be perfumed in most cases. Rose water is a useful excipient for this purpose; orange flower water is not so well liked; and elder flower water is unpleasant to many people.

Examples

℞

Sodii Carbonatis		ʒiij		12 Gm.
Aq. Flor. Aurant.		℥viij		250 Cc.

Ft. lot.

Sig. 'To be applied on lint every three hours.'

℞

Hydrarg. Perchlor.		gr. ij		0·14 Gm.
Alcoholis		ʒij		8·0 Cc.
Aq. Camphoræ	ad	℥viij	ad	250·0 Cc.

Ft. lot.

Sig. 'To be applied night and morning.'

℞

Zinci Oxidi				
Calaminæ Præp.	āā	ʒiij	āā	12 Gm.
Glycerini		ʒiij		12 Cc.
Aq. Rosæ	ad	℥vj	ad	200 Cc.

Ft. lot.

Sig. 'To be applied every morning with a pledget of cotton wool.'

℞

Sulphur. Præcip.		ʒij		8·0 Gm.
Sodii Bicarbon.		ʒij		8·0 Gm.
Glycerini		ʒij		8·0 Cc.
Alcohol.		ʒij		8·0 Cc.
Olei Lavand.		♏v		0·3 Cc.
Aquam	ad	℥viij	ad	250·0 Cc.

Ft. lot.

Sig. 'To be applied daily with gentle friction.'

℞

Liq. Picis Carbon.		ʒij		8 Cc.
Alcohol.		℥ss		16 Cc.
Aquam	ad	℥viij	ad	250 Cc.

Ft. lot.

Sig. 'To be applied morning and evening as directed.'

℞

Spir. Coloniensis . .	℥ij	50 Cc.
Aquæ	℥x	250 Cc.
Ft. lot.		

Sig. 'The affected part to be covered with lint kept constantly damp with the lotion.'

Injectiones, Collyria, etc.

These are essentially lotions applied to special parts or in a special way.

Injections (apart from hypodermic and intravenous injections) are aqueous solutions or suspensions for injecting into a mucous cavity—the rectum, vagina, urethra, bladder, etc. Those intended to be injected into the rectum are termed enemata, those for the nose collunaria. The remainder are simply termed injections, and should be prescribed as lotions, to conceal the use to which they are to be put. If the injection is large in bulk a concentrated form should be prescribed. For sensitive mucous membranes (*e.g.*, nasal) solutions should be approximately isotonic with the lymph, but, unless acutely inflamed, the mucous membranes of the rectum, urethra, and bladder are not specially sensitive, and this precaution is unnecessary.

Enemata vary in bulk according to the use to which they are to be put (page 36). Those intended to be retained (*e.g.*, nutrient enemata) should not exceed 5 ounces (150 Cc.); those for rejection may be 2 to 3 pints (1 to 1½ l.) or even more. They are relatively rarely prescribed to be dispensed, the preparation both of nutrient enemata and of enemata

for the removal of intestinal contents being within the ability of most persons. If, however, drugs not found in an ordinary household are required a prescription is necessary. This should take one of the usual forms (a lotion, a powder to be made into a lotion, etc.), and needs no further description.

The substances used as enemata (apart from those intended to be absorbed) are irritant, astringent, sedative, antiseptic, or antispasmodic in action. Evacuant enemata usually consist of water, soap and water, or salt (2 to 5 per cent.) and water, but other salts (*e.g.*, magnesium sulphate 5 to 10 per cent.), molasses (10 to 30 per cent.), oil of turpentine (1 per cent. as emulsion), vegetable infusions (*e.g.*, chamomile), and other unnecessary substances have been used. Enemata of fixed oils (½ to 1 pint—300 to 500 Cc.) are often employed if inflammation of the rectal mucous membrane is associated with hardened fæcal accumulations. Drugs employed for their action on the rectal mucous membrane are: Silver nitrate (0·1 per cent.), alum (0·5 per cent.), tannic acid (1 per cent.), lead acetate (1 per cent.), ferric chloride (2 per cent. of strong liquor), bismuth carbonate or subnitrate (1 per cent.), borax (2 per cent.), sodium bicarbonate (2 to 4 per cent.), opium or its alkaloids (a maximal dose), mucilages (25 per cent.), boric acid (sat. sol.), salicylic acid (0·3 per cent.), mercuric chloride (0·01 to 0·05 per cent.), cresol preparations (0·5 to 1 per cent.); oil of turpentine (0·5 to 1 per cent.), asafetida (5 per cent.), infusion of garlic, and similar antispasmodic substances. When an astringent or sedative action

is required, mucilage of starch forms a useful excipient.

Urethral injections are usually antiseptic or astringent in action. The number of drugs, many of them proprietary substances, which have been applied in this way is very large, and only a few of the commoner ones can be mentioned here: Silver nitrate (0·1 per cent.), potassium permanganate (0·1 to 0·2 per cent.), boric acid (1 to 2 per cent.), mercuric chloride (0·01 to 0·1 per cent.), carbolic acid (1 per cent.), zinc sulphate (0·2 to 0·5 per cent.), zinc sulphocarbolate (0·2 to 0·5 per cent.), zinc chloride (0·1 to 0·3 per cent.), copper sulphate (0·1 to 0·3 per cent.), lead acetate (0·2 to 0·5 per cent.), formalin (0·2 to 0·5 per cent.).

Vaginal injections are usually similar in character to urethral injections; they may, however, generally be used somewhat stronger. Alum (0·2 to 1 per cent.) and tannic acid (0·2 to 1 per cent.) are also frequently employed.

Vesical injections usually consist of a nearly saturated boric acid solution. Mercuric chloride (0·01 to 0·05 per cent.), silver nitrate (0·05 to 0·1 per cent.), salicylic acid (0·2 to 0·4 per cent.; sometimes with boric acid) are also used.

Collyria (eye lotions) may be antiseptic, astringent, sedative, mydriatic, or myotic in action. The number of drugs which have been employed to produce one or other effect is extremely large, and the following are only some of the more important non-proprietary substances. The solutions should be made as near isotonic as possible with the tears. Boric acid (4 per cent.), silver nitrate

(0·1 to 2 per cent.), mercuric chloride (0·05 to 0·2 per cent.), zinc sulphate (0·5 to 2 per cent.), cocaine hydrochloride (1 to 10 per cent.), atropine sulphate (0·5 to 1 per cent.), hyoscine (scopolamine) hydrobromide (0·05 to 0·2 per cent.), homatropine hydrobromide (1 per cent.), physostigmine sulphate (0·5 per cent.), pilocarpine nitrate (1 to 2 per cent.).

Collunaria, nasal injections, are usually mildly antiseptic; astringent and irritant substances are not well borne by the nasal mucous membrane. The solution should be approximately isotonic with the lymph, and if possible slightly alkaline. Boric acid (2 per cent.), borax (2 per cent.), potassium permanganate (0·1 to 0·2 per cent.), potassium chlorate (0·2 to 0·5 per cent.), sodium bicarbonate (0·1 to 0·2 per cent.), are used.

Ear drops (guttæ pro auribus).—Owing to the small capacity of the aural cavities, lotions for the ear are generally prescribed as ear drops (page 144). These, if aqueous solutions, are usually antiseptic or alkaline solutions, more rarely solutions of astringent substances. If the external auditory meatus alone is to be treated it is unnecessary to prescribe an isotonic solution, as the membrane lining the meatus is relatively insensitive. Saturated solutions of boric acid, borax, or sodium bicarbonate, zinc sulphate (1 to 2 per cent.), copper sulphate (0·5 per cent.) peroxide of hydrogen solution, are commonly used.

Collutoria, mouth washes, usually consist of mildly antiseptic or alkaline solutions. Viscous substances and substances liable to decompose (sugar, etc.) should generally be avoided. Tincture of quillaia may be employed as an emulsifying agent,

but the judicious use of alcohol, borax, and other agents will often render this unnecessary. Thus resinous tinctures, if required, may be ordered in alcoholic solution to be diluted with water just previous to use. In general, a strong wash to be diluted as directed is advisable. The wash should be pleasantly flavoured, and the least unpleasant preparations should be chosen in prescribing it; thus the tinctures of tannin-containing drugs are more palatable than tannin itself.

Examples

℞

Glycer. Acid. Tann. . .	℥ij	50 Cc.

Ft. sol.

Sig. 'Two teaspoonfuls to be added to four tablespoonfuls of water, and used as directed.'

℞

Potassii Permang. . .	gr. LX	4 Gm.
Aquæ	℥iv	120 Cc.

Ft. sol.

Sig. 'Two teaspoonfuls to be added to one pint of warm water and used as directed.'

℞

Zinci Sulphatis . . .	gr. vj	0·4 Gm.
Sodii Chloridi . . .	gr. iij	0·2 Gm.
Aquæ	℥j	30·0 Cc.

Ft. lot. Mit. in vit. stillat.

Sig. 'To be applied to the eye three times a day.'

℞

Atropinæ Sulphat. . .	gr. ij	0·13 Gm.
Sodii Chloridi . . .	gr. ij	0·13 Gm.
Aquæ	℥ss	15·0 Cc.

Ft. sol. Detur in vit. stillat.

Sig. 'One drop to be placed in the eye every evening.'

℞

Sodii Bicarbon. . . .		gr. xx	1 Gm.
Sodii Chloridi . . .		ʒiiss	8 Gm.
Aquæ		℥iv	100 Cc.

Ft. sol.

Sig. 'Two tablespoonfuls to be added to a large tumblerful of warm water and used for the nose as directed.'

℞

Boracis		gr. xv	1 Gm.
Sodii Bicarbon. . . .		ʒss	2 Gm.
Aquæ		℥j	30 Cc.

Ft. gtt. pro aur. applicand.

Sig. 'Five or six drops to be dropped into the ear three times a day.'

℞

Argenti Nitrat. . . .		gr. j	0·07 Gm.
Aquæ		℥j	30·0 Cc.

Ft. lot.

Sig. 'One teaspoonful to be used daily as directed.'

℞

Thymolis		gr. viij	0·5 Gm.
Spir. Menth. Pip. . .		ʒij	3·5 Cc.
Spir. Chlorof. . . .		ʒvj	20·0 Cc.
Tinct. Hamamel. .	ad	℥iv	ad 100·0 Cc.

Ft. collut.

Sig. 'One teaspoonful to be added to two tablespoonfuls of water and used after each meal.'

Linimenta

Liniments are liquid preparations suitable for being rubbed into the skin. They contain a fatty or saponaceous substance to facilitate this mode of application, and are usually emulsions, or solutions in fixed oils or alcohol. They are generally used to produce a stimulant or irritant action on the skin,

but occasionally they are employed to affect nerve endings (aconite and belladonna liniments) or even to obtain absorption of a drug (mercury liniment). The penetration and absorption of substances by the skin have been discussed (page 23), and it is therefore only necessary to allude to a few practical points. Fixed oils and fats are not readily rubbed into the skin. Their penetration is aided slightly by volatile liquids (*e.g.*, chloroform), and is facilitated by warming the oil prior to applying it. In the form of an emulsion equal difficulty is experienced in rubbing the oil into the skin, unless some substance is present to aid its penetration. Emulsions of wool-fat penetrate somewhat more easily; those of waxes and petroleums less easily. The use of the latter in liniments is limited. Soap emulsions penetrate somewhat better than the foregoing. Alcohol facilitates the penetration of substances, and liniments containing a large proportion of it are rapidly rubbed in. Acetic acid has a similar effect.

The prescribing of liniments does not differ essentially from that of mixtures. The limited uses of liniments and the important part played by the excipient should be remembered. *Ceteris paribus*, a substance acts more quickly and powerfully when in combination with the later than the earlier members of the following list: Petroleums and waxes, fats and fixed oils, soap, alcohol, acetic acid. The active substances in a liniment should be liquids or in solution in a liquid.[1]

[1] So-called liniments containing insoluble solids are really lotions, and are used as such. No line of division can be drawn between the two forms of preparations except by distinguishing their mode of application.

The substances most frequently prescribed as liniments are—

Solutions in fixed oils (usually olive or cotton-seed oil).—Camphor (25 per cent.), chloroform (25 per cent.), some volatile oils (*e.g.*, oil of winter-green, 25 per cent.). Carbolic acid (10 per cent.), thymol (5 per cent.), and other substances are occasionally used for special purposes.

Alcoholic Solutions.—These are generally complex in character. Soap or an alkali or oil is necessary for efficient friction. Strong ammonia liquor (20 per cent.), arnica (tincture, 20 per cent.), camphor (5 per cent.), volatile oils (5 to 20 per cent.) are frequent ingredients.

Emulsions.—Soft soap and yolk of egg are the best emulsifying agents for liniments. Oil of turpentine (30 to 60 per cent.) is usually prescribed with one of these. Other liquids immiscible with water may be emulsified in a similar way, or if soluble in fixed oils may be dissolved in these and emulsified with an alkali. Ammonia liquor is often prescribed with fixed oils, owing to its forming an emulsion with them on shaking. It must be remembered that water is necessary to produce these emulsions.

Examples

℞

Olei Gaultheriæ . . .	℥ij	50 Cc.
Olei Olivæ	℥iv	100 Cc.
Ft. lin.		

Sig. 'Two teaspoonfuls to be rubbed into the affected joints twice daily.'

℞

Chloroformi . . .	℥j	25 Cc.
Saponis Mollis . . .	℥j	25 Gm.
Alcohol.	℥ij	50 Cc.
Ft. lin.		

Sig. 'To be applied night and morning as directed.'

℞

Olei Crotonis . . .	ʒj	4 Cc.
Olei Cadini . . .	℥j	30 Cc.
Oleum Olivæ . . ad	℥iv	ad 120 Cc.
Ft. lin.		

Sig. 'To be rubbed into the affected parts every other day.'

℞

Spiritus Cajuputi . .	℥j	25 Cc.
Spiritus Rosmarini . .	℥j	25 Cc.
Spiritus Camphoræ . .	℥j	25 Cc.
Olei Ricini	℥j	25 Cc.
Ft. lin.		

Sig. 'To be rubbed into the hair every morning.'

℞

Menthol.	℥j	25 Cc.
Chloroformi . . .	℥ij	50 Cc.
Oleum Amygdal. Exp. ad	℥viij	ad 200 Cc.
Ft. lin.		

Sig. 'To be rubbed over the painful area when required.'

℞

Acidi Salicylici . . .	ʒj	4·00 Gm.
Olei Ricini	ʒij	8·00 Cc.
Olei Rosæ	♏ij	0·15 Cc.
Alcohol. . . . ad	℥iv	ad 120·00 Cc.
Ft. lin.		

Sig. 'To be applied as directed once a day.'

℞

Camphoræ		℥ss	12·5 Gm.
Acid. Acetic. Glac. . .		℥j	25·0 Cc.
Olei Terebinth. . . .		℥vj	150·0 Cc.
Vitellos ovorum . . .		ij	2
Aquam	ad	℥xij	ad 300·0 Cc.
Ft. lin.			

Sig. 'To be rubbed well into the skin over the painful parts.'

℞

Acid. Acetic. Glac. . .	℥j	25 Cc.
Olei Terebinthinæ . .	℥iij	75 Cc.
Olei Olivæ	℥iv	100 Cc.
Ft. lin.		

Sig. 'To be rubbed into the back every night.'

Cremora, creams, are emulsions for external use (liniments), having mainly a protective or emollient action. They usually consist of emulsified fixed oils. Alkalies, especially lime-water (but not ammonia water), and wool-fat are the best emulsifying agents for these preparations. Wool-fat 1 part, almond oil 3 parts, will take up 10 parts of water, but not more; wool-fat 1 part, almond oil 4 parts, will take up to 16 parts of water. Creams are really lotions, but are generally termed liniments.

Examples

℞

Adipis Lanæ . . .		℥j	30 Gm.
Olei Amygdalæ . . .		℥iij	90 Gm.
Aquam Rosæ . .	ad	℥xij	ad 360 Cc.
Ft. lot.			

Sig. 'Lint to be soaked in the lotion and applied over the affected part, twice daily.'

℞

Zinci Oxidi	℥ss	12·5 Gm.
Olei Amygdalæ . . .	℥ij	50·0 Cc.
Liq. Calcis	℥ij	50·0 Cc.
Ft. lot.		

Sig. 'To be applied on lint as directed, morning and evening.'

Pigmenta

Paints are liquids which are intended to be painted on a part by means of a brush or other suitable article. They are usually solutions, rarely suspensions, in water or in alcohol, glycerin, or other organic liquid; a few pure liquid drugs are also applied in this way. Both the skin and accessible mucous membranes are treated by this form of application. To the skin irritant preparations, and to mucous membranes astringent, antiseptic, or local anæsthetic preparations, are most frequently applied in this manner. In prescribing these solutions it is necessary to keep in mind not only the power of the excipient as a solvent, but also its influence on the penetration and absorption of drugs by the skin and mucous membranes (page 23). Speaking broadly, aqueous solutions are generally best for mucous membranes and denuded surfaces, and solutions in a volatile organic liquid (alcohol, ether, chloroform, ethyl acetate, acetone, and occasionally amyl alcohol,[1] amyl acetate,[1] and acetic acid), if compatible, for the intact skin. If a prolonged action is required, glycerin is the best

[1] Amyl alcohol and amyl acetate are useful solvents for many drugs, but they evaporate too slowly to be used alone for pigments.

excipient for drugs to be applied to mucous membranes; for substances to be applied to the skin a solution of pyroxylin, celloidin, or guttapercha (*v.i.*) which forms a pellicle on the skin, or a glycerinated gelatin or similar paste (page 231), may be used.

Collodia.—These are solutions of pyroxylin or celloidin in ethereal liquids. Collodium B.P. consists of pyroxylin 1, ether 36, absolute alcohol 12; Collodium U.S.P. of pyroxylin 4, ether 75, alcohol 25; Collodium Ph.Germ. of pyroxylin 2, ether 42, alcohol 6. When applied to the skin the alcohol and ether quickly evaporate and leave a thin transparent pellicle which gradually contracts, becomes brittle, and may peel off. As this is undesirable for most purposes, the collodion is made flexible by adding castor oil (1 to 3 per cent.), Canada turpentine (2 to 5 per cent.), camphor (20 to 40 per cent.), or similar substances. Collodium Flexile B.P. consists of collodion 48, Canada turpentine 2, castor oil 1; Collodium Flexile U.S.P. of collodion 92, Canada turpentine 5, castor oil 3; Collodium Flexile Ph.Germ. of collodion 94, castor oil 1, oil of turpentine 5; Collodium Flexile Ph.Hel. of collodion 98, castor oil 2. Acetone is a better solvent for pyroxylin than alcohol and ether, and the application of aceton-collodion produces less irritation, and the film is more elastic than that of ordinary collodion.

Collodia are employed as vehicles for the administration of various substances soluble in ethereal liquids—*e.g.*, salicylic acid (10 to 40 per cent.), iodine (5 to 10 per cent.), chrysarobin (10 per cent.), croton oil (10 per cent.), ichthyol (10 per

cent.), pyrogallol (10 per cent.), iodoform (10 per cent.), mercuric chloride (2 to 5 per cent.), oil of cade (30 per cent. in aceton-collodion). Cantharides (Collodium Vesicans B.P. et U.S.P.) is also conveniently applied in this form. Carbolic acid gelatinises collodion; the jelly is largely sold under the name 'toothache jelly.'

Traumaticin, a solution of guttapercha (1) in chloroform (10), is used as a vehicle for chrysarobin, pyrogallol, and similar drugs. After applying to the skin the chloroform evaporates and leaves a thin coat which adheres well. Solvents other than chloroform have been used, but they possess no obvious advantages.

Examples

℞
Liquoris Iodi
Tincturæ Iodi . . āā ℥j āā 25 Cc.
Ft. pigm.

Sig. 'To be applied daily over the back until tenderness is produced.'

℞
Acidi Chromici . . . gr. x 0·6 Gm.
Aquæ . . . . . ℥j 30·0 Cc.
Ft. sol.

Sig. 'To be applied as directed, once a day.'

℞
Liquoris Potassæ . . ℥ij 60 Cc.
Ft. sol.

Sig. 'To be painted on the affected parts daily.'

℞
Chloral. Hydrat.
Mentholis . . āā ℥ss āā 15 Gm.
Ft. pigm.

Sig. 'To be painted over the painful area when required.'

℞

Resorcini		ʒij		6 Gm.
Glycerini		℥j		25 Cc.
Ft. pigm.				

Sig. 'The patches to be painted with the liquid once a day.'

℞

Hydrarg. Perchlor. . .		gr. viij		0·25 Gm.
Acidi Salicylici				
Acidi Carbolici . .	āā	gr. lxxx	āā	2·5 Gm.
Glycerinum . .	ad	℥ij	ad	50·0 Gm.
Ft. pigm.				

Sig. 'To be applied daily, as directed.'

℞

Picis Liquidæ				
Alcohol. Absol. .	āā	℥j	āā	25 Cc.
Misce.				

Sig. 'The patches to be painted once daily.'

℞

Glycer. Acid. Tannici .		℥j		30 Cc.
Ft. pigm.				

Sig. 'The throat to be painted with the liquid after each meal.'

℞

Ext. Belladon. Alc. . .		℥j		30 Gm.
Aquæ		ʒj		4 Cc.
Glycerinum . .	ad	℥ij	ad	60 Gm.
Ft. pigm.				

Sig. 'To be applied as directed over the painful area.'

℞

Acidi Salicylici		ʒj		4·0 Gm.
Cocainæ		gr. x		0·8 Gm.
Ext. Bellad Alc. . . .		ʒss		2·0 Gm.
Collodium . . .	ad	℥ss	ad	15·0 Cc.
Ft. pigm.				

Sig. 'To be used daily, as directed.'

Pulveres

Powders are finely divided solids or mixtures of solids. Almost any solid or combination of solids can be prescribed as a powder; but, speaking generally, drugs which are unstable in air—*e.g.*, deliquescent[1] and volatile[2] substances, and mixtures of substances liable to explode (page 80) or to liquefy (page 74), should not be prescribed in this form. Some powders will bear the addition of considerable quantities of liquid without apparent physical change (see below).

Powders are employed as dusting powders, insufflations, etc., for a local effect, and are given internally to produce a general action. For convenience, drugs are also prescribed as powders for preparing lotions, washes, baths, etc.[3] Powders for external use are commonly prescribed in bulk, those for internal administration in single doses. But whenever accuracy is essential, whether the powder is for internal or external use, the practice of ordering definite quantities for each administration should be resorted to. 'Penknife pointfuls,' 'what

[1] Some of the more important compounds tending to deliquesce are—the chlorides, bromides, and iodides of lithium, calcium, strontium, magnesium, iron, manganese, gold, and zinc; potassium acetate and carbonate; sodium iodide and nitrite; carbolic acid, chromic acid, pilocarpine hydrochloride, and hyoscyamine hydrochloride. The scale preparations of iron and pepsin become damp, as does chlorinated lime.

[2] Some compounds decompose gradually on exposure. Lead acetate and morphine acetate lose acetic acid, the iodides of sulphur and of arsenium lose iodine.

[3] Coarse powders ('species') are sometimes prescribed for making 'teas' (infusions).

will lie on a sixpence or ten-cent piece,' are variable quantities. On the other hand, comparatively harmless powders for internal administration—*e.g.*, compound liquorice powder, saline purgatives—may be ordered in bulk, with teaspoonful or larger doses.

Powders in bulk are usually dispensed in wide-mouthed bottles or in boxes, or merely wrapped up in paper; small powders are wrapped up in powder papers and put into a powder envelope, or, if numerous, into a box. If any special container is required, it is well to indicate it in the subscription—in pyxidem spersoriam (in a sprinkling (powder) box); in ollam fuscam (in an amber-coloured bottle); in chartas ceratas (in waxed papers). Such precautions may be necessary if the powder is slightly deliquescent or hygroscopic, affected by light, etc.

It is advisable to inform the patient or nurse how the powders may best be taken, unless directions are given in the prescription—whether they should be placed on the tongue and washed down with water, or added to water, syrup, milk, or other fluid, or mixed with jam, treacle, chocolate, or similar agent. The latter class of substances are often useful for administering powders to children; but it should not be forgotten that jams are usually acid, and that incompatibility may arise in consequence. Nauseous powders are sometimes wrapped in wafer-paper, which is first moistened by dipping it into warm water. The powder is then placed in the centre of the paper, the paper is folded or screwed up, and the whole swallowed. This

method has been largely superseded by the introduction of cachets, which, however, should be ordered by the physician (page 199). Powders may also be prescribed as tablets (page 195).

When dispensed, each ingredient of a powder should be uniformly distributed through the mass, and when thrown on to water its particles should not cohere to form lumps. Some drugs in powder form—sulphur, resins, camphor, etc.—do not fulfil the latter requirement, and such are advisedly prescribed combined with other drugs. The character of a powder, when dispensed, largely depends upon the method of mixing adopted by the dispenser (*cf.* page 272).

As most solids can be prescribed as powders, no exhaustive list of substances which may be so prescribed can be given or is required. A few general remarks only will be made. Except as a matter of convenience for the patient, the prescribing of powders for internal administration is best adapted for substances but slightly soluble in water, and especially for substances which are required to act mainly on the alimentary tract. Powders for local use also generally consist, in the main, of insoluble or slightly soluble compounds. Readily soluble substances are occasionally used (for styptic, caustic, etc., actions), but are more frequently prescribed in this form for preparing lotions, injections, etc.

Powders commonly used externally are—

Starch, kaolin, talc, kieselguhr—mainly as protective and drying agents and excipients.

Zinc oxide and carbonate, bismuth oxide, carbonate, subnitrate, and oxysalicylate—as protective and slightly astringent agents.
Alum, tannic acid—as astringent substances.
Boric acid, iodoform and its substitutes, carbolic acid (5 per cent. with talc), salicylic acid (3 per cent.), naphthol (10 per cent.), thymol (2 per cent.)—as antiseptic substances.
Other powders—camphor, charcoal, chalk, orthoform, soap, sulphur, etc.—are sometimes used for special purposes. Caustic powders (*e.g.*, caustic potash with lime) are rarely employed in this country.
Liquids may be incorporated with some diluent powders and used as powders. Starch and kaolin will bear the addition of at least 10 per cent. of their weight of liquid, and kieselguhr will carry much more without apparent change.

Substances given as powders internally include alkaloidal salts, glucosides, neutral principles, inorganic and synthetic organic compounds, crude vegetable drugs and vegetable products. As many of these possess a dose of less than 1 grain (0·065 Gm.), it is necessary, in prescribing, to add some diluent to bring each powder to a weighable and administrable size. For this purpose sugar of milk is usually employed. It is slightly sweet, is innocuous, and its particles do not tend to cohere. Cane sugar, starches, and gums are less suitable, but some inorganic powders and crude

vegetable powders are occasionally used with advantage.

Effervescing powders may be prescribed by ordering the neutralising equivalents[1] of sodium or potassium bicarbonate and tartaric or citric acid in the same powder, with or without other medicinal agents; or the acid and alkali may be ordered in separate powders, as in the common seidlitz powders. This is advisable if any of the ingredients of the powder are hygroscopic; but in such cases a better plan generally is to order the mixture to be granulated.

Examples

℞

Phenacetini	. . .	gr. x	0·65 Gm.

Ft. pulv. Mitte tales pulveres xij.

Sig. 'One to be taken night and morning.'

℞

Phenacetini	. . .	gr. x	0·65 Gm.
Caffeinæ	. . . .	gr. ij	0·15 Gm.
Sodii Bicarbonatis	. .	gr. v	0·32 Gm.

Ft. pulv. Mitte tales pulv. iv.

Sig. 'One to be taken in water when required.'

℞

Bismuthi Subcarbonatis	.	ʒij	8·0 Gm.
Sodii Bicarbonatis	. .	ʒj	4·0 Gm.
Cinnamomi	. . .	gr. xv	1·0 Gm.
Zingiberis	. . . .	gr. v	0·3 Gm.

Ft. pulv. Divide in partes æquales xij.

Sig. 'One powder to be taken before each meal.'

[1] 20 grains of sodium bicarbonate = 24 grains of potassium bicarbonate = 18 grains of tartaric acid = 17 grains of citric acid.

℞

Bismuthi Subnitratis . .	ʒij	8·0 Gm.
Rhei Radicis . . .	ʒij	8·0 Gm.
Capsici	gr. x	0·65 Gm.

Ft. pulv. Div. in part. æq. xij.

Sig. 'One powder to be taken three times a day, before meals.'

℞

Morphinæ Hydrochloridi .	gr. $\frac{1}{5}$	0·013 Gm.
Camphoræ	gr. iij	0·2 Gm.
Sacchari Lactis . . .	gr. vj	0·4 Gm.

Ft. pulv. M. t. p. x.

Sig. 'One powder to be taken night and morning.'

℞

Hydrargyri c̄ Creta . .	gr. j	0·065 Gm.
Sacchari Purificati . .	gr. ij	0·13 Gm.

Ft. pulv. M. t. p. vj.

Sig. 'One powder to be taken every evening.'

℞

Hydrargyri Subchloridi .	gr. ij	0·13 Gm.
Jalapæ	gr. x	0·65 Gm.
Sacchari Purificati . .	gr. v	0·32 Gm.
Olei Carui	gtt. j	gtt. j

Ft. pulv.

Sig. 'The powder to be taken in the early morning.'

℞

Rhei Radicis	gr. iv	0·25 Gm.
Magnesiæ Levis . . .	gr. xij	0·75 Gm.
Zingiberis	gr. iv	0·25 Gm.

Ft. pulv. Mitte tales pulv. ix.

Sig. 'One powder to be taken three times a day, after meals.'

[Pulvis Rhei Compositus B.P.]

℞

Kino	gr. xv	1·0 Gm.
Opii	gr. j	0·065 Gm.
Cinnamomi . . .	gr. iv	0·26 Gm.

Ft. pulv. M. t. p. iv.

Sig. 'One powder to be taken every evening.'

[Pulvis Kino Compositus B.P.]

℞

Betanaphtholis . . .	ʒj	4·0 Gm.
Bismuthi Subsalicylatis .	ʒij	8·0 Gm.
Glusidi	gr. ij	0·13 Gm.
Sacchari Lactis . . .	ʒij	8·0 Gm.

Ft. pulv. Div. in part. æq. xij.

Sig. 'One powder to be taken three times a day, after food.'

℞

Jalapæ	gr. LX	4·0 Gm.
Potassii Tartratis Acidi .	gr. cviij	6·5 Gm.
Zingiberis	gr. xij	0·8 Gm.

Ft. pulv. Div. in part. æq. iv.

Sig. 'One powder to be taken every morning.'

[Pulvis Jalapæ Compositus B.P.]

℞

Cretæ Præparatæ . .	gr. ix	0·6 Gm.
Acaciæ Gummi . . .	gr. vj	0·4 Gm.
Sacchari Purificati . .	gr. xv	1·0 Gm.

Ft. pulv. M. t. p. xij.

Sig. 'One powder to be taken three times a day, after food, until the diarrhœa cease.'

[Pulvis Cretæ Compositus U.S.P.]

℞

Santonini	gr. ij	0·13 Gm.
Sacchari Purificati . .	gr. iij	0·2 Gm.

Ft. pulv. Mitte tales pulveres iij.

Sig. 'One powder to be taken every other night, at bedtime.'

℞

Sodæ Tartaratæ . . .	gr. cxx	8·0 Gm.
Sodii Bicarbonatis . .	gr. XL	2·8 Gm.

Ft. pulv. Pone in chartam cæruleam.

Acidi Tartarici . . .	gr. xxxviij	2·5 Gm.

Ft. pulv. Pone in chartam albam.

Sig. 'Dissolve the contents of the blue paper in half a pint of water, add the contents of the white paper, and drink the solution whilst effervescing. To be taken an hour before breakfast.'

Insufflations are powders which are blown by means of a special apparatus (an insufflator) into mucous cavities—the nose, larynx, vagina, etc. The powder should be in a very finely divided state and, speaking generally, should contain less of any irritating substance than similar powders for use on the skin.

The substances or mixtures most frequently prescribed as insufflations have a mild astringent, antiseptic, or sedative action, but strongly astringent powders are occasionally administered in this way. Bismuth subnitrate, zinc oxide, starch, and boric acid form useful diluents for more active drugs. Calomel is sometimes vaporised and the vapour insufflated.

Examples

℞

Acidi Tannici . . .	gr. iv.	0·25 Gm.
Amyli	gr. xxv.	1·6 Gm.

Ft. pulv. M. t. p. xij.

Sig. 'One powder to be insufflated as directed twice a day.'

℞

Orthoformi		
Acidi Borici . .	āā ℥ss	āā 15 Gm.

Ft. pulv. Div. in part. æq. xvj.

Sig. 'One powder to be insufflated night and morning.'

PILULÆ

Pills are small spherical or spheroidal masses of medicinal substances, usually plastic in consistence, intended to be swallowed whole. They are generally made from 1 to 3 grains in weight and should not exceed, with rare exceptions, 5 grains.

Being plastic bodies they do not, as a rule, disintegrate quickly in the alimentary canal, hence medicines given in this form are liable to be absorbed more slowly and to exert a greater effect upon the intestinal mucous membrane than when given in other ways.

Medicines are given in this form (i.) to avoid a local effect on the mouth (nauseous or acrid taste, etc.); (ii.) to produce a better local action on the intestines; (iii.) to obtain a slower absorption and gentler and more prolonged action; (iv.) occasionally as a matter of convenience to the patient. Some patients find it difficult to swallow pills. The feeling of a pill on the tongue appears to exert an inhibitory action on the centre governing deglutition. In these cases it is necessary to wash the pill down with draughts of fluid. Pills should not be given to unconscious patients or young children.

The chief difficulty in prescribing pills is the production of a proper pill mass. This should be of clay-like consistence—that is, it should not be too adhesive, but should be capable of being moulded, without crumbling, with moderately strong pressure. Opium and a few unimportant drugs approach this consistence, and consequently may be

made into pills without any addition; but most drugs are too solid or liquid for this to be done, hence a combination of substances is necessary. Sometimes a suitable consistence can be obtained by the judicious combination of active substances, but more commonly the addition of one or more comparatively inert solids, semi-solids, or liquids—the excipient—is required. The choice of an excipient is frequently left to the dispenser, *e.g.*:

℞
Hydrarg. Subchlor. . . . . . . gr. ij
Fiat pilula. Mitte tales pilulas no. xij.

In such a case the dispenser employs the excipient which he thinks will make the smallest and best pills. And generally his judgment may be relied upon. But in his endeavour to produce an elegant pill he sometimes falls into the error of using substances which will retard and even prevent disintegration. It is therefore advisable that the prescriber should indicate the excipient he desires to be employed, even at the cost of less elegant pharmacy. The quantity of excipient is, generally, best left to the dispenser.

The selection of an excipient is of some importance. Not only must the excipient or excipients be able to form a pill mass which can be dispensed, but the pills when made must be of reasonable size, must retain their properties as long as is necessary, and especially must be capable of being disintegrated in the alimentary canal.

Excipients may be divided into (*a*) liquid and semi-liquid excipients, (*b*) solid excipients.

Liquid and semi-liquid excipients act in one or both of two ways: (i.) by a solvent action on one or more constituents of the pill; (ii.) by an adhesive action—*i.e.*, by uniting the incoherent particles into a plastic mass. Most excipients of this group act in both of these ways. An excipient having a purely solvent action is comparatively rarely useful unless some other ingredient or ingredients of the pill are potentially or actually adhesive in nature. Thus while water will mass powders containing a considerable proportion of soap, and alcohol or diluted alcohol powders containing much resin, neither water nor alcohol will form a satisfactory mass with most inorganic or organic substances, because the particles of these after evaporation of the water or alcohol do not possess the property of cohesion to the necessary degree. Some excipients of this class which do not evaporate will produce, however, a satisfactory pill mass with pure substances. Thus sulphuric acid will mass quinine sulphate; glycerin, tannic acid or benzoic acid; castor oil, camphor. Generally, however, a purely solvent excipient is insufficient. It produces a small pill, but in many instances the mass formed is either too crumbly or too soft for convenience. Excipients which act mainly or solely by imparting adhesiveness are most generally applicable, but they increase the size of pills, and some diminish their power of disintegration more than the purely solvent class.

The most important liquid and semi-liquid excipients are syrupy glucose and similar substances (treacle, honey, etc.), glycerin of tragacanth and its modifications, and vegetable extracts.

Many others have been employed, but they rarely possess any decided advantages.

Glucose (syrupy glucose, a very viscid substance containing a considerable percentage of dextrine) is an excipient of wide application. It is best adapted for substances or mixtures on which it can exert a solvent action. It has not the requisite binding qualities to form a good pill mass with insoluble powders alone. For such the addition of powdered soap or similar binding agent is necessary. (Glucose is generally diluted for dispensing purposes with about half its weight of syrup. This mixture is more easily manipulated and forms somewhat smaller pills in many instances than undiluted glucose.)

Syrup of glucose B.P. (syrup 2, glucose 1) is less viscous and adhesive than glucose alone, but it is a satisfactory excipient if other binding substances are among the ingredients of the pill. It is used for a number of the pills in the British Pharmacopœia.

Treacle, honey, and *extract of malt* possess similar properties to glucose, but are not quite so good.

Syrup is not, speaking generally, a good excipient. It is only slightly cohesive, and should only be used if other ingredients of the pill possess binding qualities in themselves. This is, *a fortiori,* also true of water.

Mucilage of acacia alone is of little use as an excipient. It has powerful binding properties, but the pills by keeping become hard and often will not disintegrate.

Glycerin possesses the desirable quality of keeping the pill mass soft. It is too hygroscopic for use alone, and is generally diluted before use with an equal quantity of water. It possesses but little cohesive power, and consequently can only be used if this is inherent in other ingredients of the pill. A mixture of equal parts of glycerin, mucilage of acacia, and syrup forms a moderately good general excipient.

Alcohol will form a workable pill mass if resinous substances are predominant ingredients of the pill, but if used alone such pills generally become hard and disintegrate slowly. The addition of glycerin and water will prevent this to some extent, but unless the resin of the pill is relatively small in quantity, even diluted alcohol is not a desirable excipient therapeutically.

Volatile oils are not usually regarded as pill excipients, but if resinous ingredients are present they may act as such.

Glycerin of tragacanth is one of the most generally useful excipients: it will mass almost any dry powder, and the pills when made disintegrate fairly readily. About 1 part to 4 parts of powder is generally sufficient (*cf.* tragacanth, page 179). The addition of an equal part of glucose to this excipient is often an improvement.

Glycerinated gelatin (glyco-gelatin) is occasionally useful, but is not so good as glycerin of tragacanth.

Confection of roses possesses no obvious advantages as a pill excipient. A relatively large quantity is required, and consequently it tends to

increase the bulk of pills unnecessarily. It is employed as an excipient in some of the aloetic pills and the mercury pill of the British Pharmacopœia.

Wool-fat with talc or other inert powder is a useful excipient for some salts of the heavy metals which are decomposed when massed with vegetable substances. It may also be employed for slightly hygroscopic substances.

Solid excipients.—These may act the part mainly of (i.) diluents or absorbents, (ii.) binding agents. As diluents for powerfully active drugs—*e.g.*, arsenious anhydride—or diluents for liquid or semi-liquid substances almost any inert insoluble or slightly soluble powder may be used. Calcium phosphate, kaolin, sugar of milk, will suffice for most purposes. But these substances possess no binding quality, hence it is necessary to add other excipients to produce plasticity of the mass unless the property is inherent in the active ingredient.

The only solid excipients that require notice are those of group (ii.)—*i.e.*, those which increase the cohesion of the particles of the pill mass. The most important of these are powdered tragacanth, soap, liquorice root, marshmallow root, flour, and manna.

Tragacanth, in the presence of moisture, is a powerful binding agent. A relatively small quantity only is required (5 to 10 per cent.): a large quantity makes the pill mass very elastic and delays the disintegration of the pill. It is best used in conjunction with glycerin (about twice its weight), which, being hygroscopic, attracts sufficient

moisture to make the tragacanth effective; but it may be employed as a subsidiary excipient to improve the consistence of a mass otherwise too soft or crumbly. As tragacanth requires water for its action it is useless employing it with alcohol or volatile oils alone as an excipient. Tragacanth and glycerin are used as excipients in Pilula Quininæ Sulphatis B.P.

Compound tragacanth powder or similar preparation is even better in many cases than tragacanth alone. The gum acacia present is powerfully cohesive in action, and the sugar, while acting as a binding agent, aids the subsequent disintegration of the pill. The starch is of little value. About 10 to 20 per cent. of this powder, with sufficient glycerin and water, is necessary to mass most substances.

Soap powder, next to tragacanth, is the most powerful agent of this class. About 20 per cent. is needed for most drugs. It is especially useful as an excipient for vegetable powders, extracts, oily and resinous substances, but it should not be associated with soluble acids (*e.g.*, tannin) or soluble inorganic salts except those of alkali metals. Water alone may generally be used to mass a powder containing it, but syrup or syrup of glucose is better.

Powdered curd soap (Sapo Animalis) is regarded as a more powerful binding agent than powdered hard soap (Sapo Durus).

Marshmallow root (althæa) forms a useful absorbent and binding powder. It contains a considerable quantity of mucilage, and, largely on this account, if used alone, it tends to produce pills

which become hard by keeping and disintegrate only with difficulty. It is best employed in combination with soap, extracts, or similar excipients to improve the consistence of a mass. Not more than 10 to 20 per cent. should be prescribed.

Liquorice root makes a good absorbent powder which is less cohesive when moistened than marshmallow root, and on this account is more generally useful. It must be employed in conjunction with soap, extracts, or other excipient. With about half its weight of extract of liquorice and sufficient water it forms a tolerably good general excipient. Its chief value is its fibrous nature; owing to this, pills containing it are able to retain their shape for long periods.

Flour with small quantities of water is a useful excipient for whitish substances, such as calomel. It is not a good absorbent for liquids.

Bread crumb as an excipient has fallen almost into disuse. It is somewhat variable in composition and is lacking in binding qualities. It is sometimes used as an absorbent of volatile oils and similar substances, but it possesses no decided advantages.

Manna is a useful excipient for small quantities of calomel and most other powders; it will even serve for small quantities of slightly deliquescent salts. It has not, however, strong binding qualities, and used alone tends to form a somewhat crumbly pill.

Cacao butter has been recommended as an excipient for some oily and oxidising substances. Theoretically it is the best solid fat to use when such is believed to be indicated, but pills made with

it may be required to be coated with chocolate owing to the difficulty of handling them.

Extracts (excluding liquid or fluid extracts) are usually given in the form of pills; it may be said that they are made for that purpose. Unfortunately, the consistence of different extracts varies —even the same extract may become dryer by keeping—and this, without some knowledge of the consistence of extracts, makes the prescribing of a good pill mass somewhat difficult. The point of greatest importance is to avoid prescribing a pill mass which is too soft, since this means the evaporation of the extract, or the addition of an inert powder and consequently a larger pill. A hard pill mass is of less moment, since the addition of a little water or alcohol will make it of workable consistence.

A practical knowledge of the consistence of extracts may be gained by dividing them into those of pilular or nearly pilular consistence, and those which are harder (practically dry) and softer than this. The following are those official in the British Pharmacopœia:

Softer	Pilular Consistence	Harder
Ext. Belladonnæ Alcoh.	Ext. Anthemidis	Ext. Aloes Barb.
— Cannabis Indicæ	— Belladonnæ Viride	— Euonymi Sicc.
— Colchici	— Cascaræ Sagradæ	— Glycyrrhizæ
— Ergotæ	— Colocynthidis Co.	— Krameriæ
— Hyoscyami Viride	— Gentianæ	— Opii
— Nucis Vomicæ	— Jalapæ	— Rhei
— Physostigmatis		
— Stramonii		
— Strophanthi		
— Taraxaci		

Most of the powerfully active extracts are soft in consistence; the inert extracts tend to be hard. Extractum Opii and Extractum Taraxaci are the most noteworthy exceptions.

The United States Pharmacopœia directs nearly all extracts to be evaporated to a pilular consistence or to dryness. Extractum Malti is evaporated to the consistence of thick honey. Extractum Ergotæ is made to a definite weight.

Pilular Consistence	Dry
Ext. Belladonnæ Foliorum	Ext. Aloes
— Cannabis Indicæ	— Cimicifugæ
— Colchici Cormi	— Colocynthidis
— Digitalis	— Colocynth. Co.
— Ergotæ	— Glycyrrhizæ
— Gentianæ	— Hæmatoxyli
— Glycyrrhizæ Purum	— Krameriæ
— Hyoscyami	— Leptandræ
— Rhei	— Nucis Vomicæ
— Scopolæ	— Opii
— Stramonii	— Physostigmatis
— Sumbul	— Quassiæ
— Taraxaci	— Rhamni Purshiani

Extracts possess considerable binding properties and play an important part as excipients. With the addition of water or diluted alcohol, if necessary, they will mass two to four times their weight of a vegetable powder; and they are best so combined. Few extracts make good pills alone.

Undesirable excipients.—The student has already been advised to acquire the habit of indicating the excipient when prescribing pills. If as a practitioner he leaves this to the dispenser, it

is probable that a smaller and more highly finished pill will be sent out, but this result may be obtained at the expense of therapeutic efficiency. A dispenser is not expected to be acquainted with the pharmacological action of drugs, and no blame can be attached to him if he chooses an unsuitable excipient.

The most undesirable excipients are waxes, paraffins, and Canada balsam. These substances prevent or delay disintegration of a pill in the alimentary canal, and the action of the remedy may thereby be frustrated. Magnesia, which is a favourite diluent excipient of many pharmacists, should likewise be avoided. It reacts with a large number of substances, and in some cases produces pills which will not disintegrate, and which are therefore useless. If much resin or alcohol-soluble substances occur in a pill, alcohol should not be employed as the excipient; it produces a pill which takes a long time to dissolve. Fats also should be avoided as far as possible. They tend to prevent disintegration, but least so if combined with starch or similar powder. Wool-fat is least objectionable.

The prescribing of drugs as pills.—It is only necessary to summarise under this head what has been said under excipients, and consider a few special cases as examples. The physical character of the drug is generally of paramount importance—if a solid, it will require a liquid (and possibly a solid) excipient; i a liquid it will require a solid (and possibly a liquid) excipient. Chemical

characters are usually of lesser importance; little (if any) of the ingredients of pills is in solution, and hence chemical interchange is less liable to occur. They should, however, be kept in mind, especially in prescribing substances which readily oxidise or reduce (page 81).

Solid substances.—Most solid substances can be made into satisfactory pills by using glycerin of tragacanth, a mixture of syrup, glycerin, and mucilage, soft extracts, manna and water, flour and water, or any of many other adhesive substances or preparations as excipients, but no single excipient is best under all circumstances.

For pure inorganic and organic substances glycerin of tragacanth (about 10 per cent.) is of widest applicability, but the pills made with it are often either too soft or too elastic for well-made pills. They disintegrate readily, however, when placed in water. The addition of flour often improves them. Compound tragacanth powder (B.P.) (about 10 per cent.) with glycerin and water may also be used to mass such substances; and the mixture of syrup, glycerin, and mucilage (about 5 per cent.) is generally efficient and makes small pills. Manna tends to make bulky pills, and is consequently only adapted for substances having relatively small doses. For such substances powdered soap (if compatible), a vegetable powder (*e.g.*, liquorice powder), and syrup or syrup of glucose may be used if the pill is to be coated. This mixture makes a good workable mass and a well-finished pill, but the pills tend to become hard by keeping. Glycerin may be added to prevent this,

if necessary, unless the pill contains a metallic oxide, with some of which glycerin forms a cement-like substance.

Solid substances adhesive in nature, such as aloes, citrate of ammonium and iron, or hard extracts, require water or, better, syrup or syrup of glucose, and an inert powder. A pill can often be made with water or syrup alone as excipient, but this course is not recommended.

Vegetable powders may generally be satisfactorily prescribed with soap and syrup of glucose, or with one or more of the softer extracts or a hard extract and water or syrup.

Resinous powders should be prescribed with a vegetable powder, soap, and water or syrup. Alcohol, more or less diluted, is, from a pharmaceutical point of view, a valuable excipient for such pills, but it tends to produce pills which do not disintegrate readily.

Deliquescent salts should not be prescribed as pills unless their dose is small, in which case they may be ordered with an absorbent powder and an adhesive excipient. Manna with tragacanth is often suitable, but glycerin should be avoided. Wool-fat has been recommended. The pills should be sent out in bottles filled up with a powder to exclude air.

Liquids up to one minim doses may be given as pills, but they are generally more conveniently taken as capsules. An absorbent powder—*e.g.*, liquorice powder or flour—is necessary to take up the liquid, and soap and syrup or similar excipients are required to give it consistence. Speaking generally, fixed oils require a preponderance of soap

(with which they are first mixed), other liquids require more of an absorbent powder.

A smaller pill can often be made by using calcium phosphate, kaolin, or kieselguhr as an absorbent powder and massing with glycerin of tragacanth or similar excipient. A glycerin jelly with flour or compound tragacanth powder has been recommended.

Oleo-resins may be prescribed with an absorbent powder or, better, with this and soap and syrup. These substances, however, are better administered in other ways than in pills.

Soft extracts merely require an inert powder to produce a mass of proper consistence.

Special Drugs.—A few substances, owing to their chemical characters, give rise to difficulties in prescribing as pills. For the most part they are powerful oxidising or reducing agents, and more particularly silver nitrate and oxide, and phosphorus.

Silver nitrate and oxidising agents generally must be massed with non-oxidisable substances. Kaolin is used as a diluent powder, and a paraffin (soft paraffin or paraffin ointment), or anhydrous sodium sulphate with water, as the excipient. Kaolin and paraffin make satisfactory pills, but the pills do not disintegrate readily. Pills made with kaolin (2 parts) and anhydrous sodium sulphate (1 part), on the other hand, although very hard, disintegrate rapidly, and for most purposes this is the best excipient to use.

As this method is not very well known, and is too advanced for insertion in the chapter on Dispensing, a brief description of

it is given here. The powdered drug is mixed with the requisite amount of kaolin, half as much anhydrous sodium sulphate as kaolin is added, and, after mixing, the whole is massed with about the same weight of water as of sodium sulphate. The mass must be kept above 33° C. until the pills are finished. When the pills fall to the room temperature they become of stony hardness. The method depends on the fact that 33° C. is a critical temperature for sodium sulphate. Above that temperature the sodium sulphate exists in the anhydrous form, and hence the water is free and the mixture is a plastic mass; below 33° C. the sodium sulphate exists as $Na_2SO_4,7H_2O$, hence when the temperature falls this hydrated salt crystallises out and the pills rapidly become hard. The pills quickly disintegrate owing to the ready solubility of this salt in water.

Phosphorus, owing to the rapid oxidation it undergoes in contact with air, is a troublesome substance to dispense as pills. The difficulties, however, have been exaggerated, and some of the measures recommended to overcome them have produced a pill so permanent that it would not disintegrate. An inert powder, compound powder of tragacanth or similar mixture, and glycerin and water, or even a vegetable powder and syrup of glucose, produce a satisfactory pill. The pills should be freshly made and should be thinly varnished. Oil of theobroma has been suggested as a medium, the phosphorus being dissolved in it and the mixture moulded into pills. These pills should be coated with chocolate owing to the difficulty of handling them.

Other substances (carbolic acid, camphor, salts of heavy metals, etc.) may give rise to incompatibility when prescribed in combination, but owing to little (if any) of the ingredients of pills being in

solution, this is less liable to occur than in the case of mixtures. Calcium sulphide, however, should not be prescribed with an aqueous excipient, as sulphuretted hydrogen is liberated and escapes.

Occasionally pill masses which involve chemical interaction are intentionally prescribed. Pilula Ferri B.P., Massa Ferri Carbonatis, Pilula Ferri Carbonatis U.S.P., are cases in point. Pills of iodide of iron have also been ordered by writing the iron and iodine separately on the prescription, but the student is recommended to avoid such measures unless he is well acquainted with the interaction that occurs.

Pill-coating.—Pills are coated (i.) to cover a nauseous taste, (ii.) to preserve them, (iii.) to give them a more elegant appearance, (iv.) to prevent disintegration in the stomach. If not coated, pills are sent out in a circular cardboard box or a bottle, and are well sprinkled or covered with an inert powder, usually lycopodium or powdered liquorice root. If cinnamon, sugar, or other powder is preferred it should be indicated on the prescription.

The pill-coatings employed for (i.), (ii.), (iii.) are: gelatin, sugar, talc, chocolate, resin, wax, silver leaf, and gold leaf; for (iv.), keratin, glutoid, salol, and collodion. If pills are to be coated they should not contain hygroscopic substances, either as active ingredients or as excipients (*e.g.*, glycerin); and as the pills are often surface-dried by heat they should not contain substances affected by slight heat. All coatings delay the disintegration of the pill to a greater or less degree.

Gelatin coating is the most generally useful. It is easily and quickly done, is economical, is elegant in appearance, and, what is of most importance, it is readily soluble. To improve the appearance of the pills they may be rolled in a white or black inert powder (*e.g.*, slightly moistened lampblack, starch, etc.) before coating, or the gelatin solution used for coating may be coloured and even flavoured.

Sugar coating is, next to gelatin, the most useful coating. It is readily soluble, and when done on a large scale in properly heated and revolving pans has an elegant appearance. On a small scale, however, it is somewhat troublesome to do, and the high finish of commercially coated pills cannot be attained. As sugar alone gives too translucent a coating, flour or similar substance is added to increase the opacity and produce a whiter appearance. At the dispensing counter sugar of milk often replaces cane sugar in sugar coating, as it gives a better result when employed on a small scale.

Talc, or 'pearl' coating, possesses no advantages from a prescriber's point of view. It is more easily done, and prevents disintegration of the pill longer than sugar coating.

Chocolate coating is comparatively rarely prescribed. Owing to containing an oil of theobroma basis it is soft to handle, and it possesses no obvious advantages unless a fatty excipient has been used. This is also true of a mixture of starch and cacao-butter, which has been employed for coating.

Varnishing, or resin coating, is a good protective, and is easily and quickly done, but it delays dis-

integration of the pill considerably. It is the best form of coating for pills containing substances attacked by the air (*e.g.*, phosphorus pills, pills containing ferrous iodide), but the coating is often made too thick by the dispenser. A tolu varnish is the best.

Waxing of pills should not be prescribed.

Silvering is an old method which is rapidly falling into disuse. It is quickly done and makes elegant pills, but it possesses no other advantages. It should not be ordered for pills containing sulphides.

Gilding possesses no advantages and is costly.

Keratin coating has only been used to prevent disintegration of pills in the stomach. It is of questionable value, and is very difficult to do on a small scale. It should not be prescribed.

Glutoid (formaldehyde gelatin) coating is also difficult to do. It is better to order the contents of the pill in glutoid capsules, which can be obtained commercially.

Salol coating is the easiest to do of these specialised forms of pill-coating, but it is questionable if it can be depended on to protect a pill from the action of the gastric contents. The salol coat is somewhat brittle, and consequently pills so coated need gentle handling. They are commonly sent out in bottles or boxes lined with cotton wool.

Collodion coating is probably more efficacious in preventing disintegration of the pill in the stomach.

Other forms of coating have been prescribed and practised, but they do not merit consideration.

Examples

℞

Acidi Arseniosi . . .	gr. $\frac{1}{40}$	0·0016 Gm.
Farinæ Tritici . . .	gr. ij	0·13 Gm.
Aquæ	q.s.	q.s.

Ft. pilula. Mitte tales pilulas xx.

Sig. 'One to be taken morning and evening, after food.'

℞

Digitalis Foliorum . .	gr. j	0·065 Gm.
Scillæ	gr. j	0·065 Gm.
Extracti Hyoscyami . .	gr. j	0·065 Gm.

Ft. pil. M. t. p. xij.

Sig. 'One to be taken three times a day, after food.'

℞

Camphoræ	gr. ij	0·13 Gm.
Opii	gr. j	0·065 Gm.
Saponis Duri . . .	gr. j	0·065 Gm.
Syrupi	q.s.	q.s.

Ft. pil. Mitte xij.

Sig. 'One to be taken every eight hours.'

℞

Calcis Sulphuratæ . .	gr. x	0·65 Gm.
Sacchari Lactis . . .	gr. LX	4·0 Gm.
Glycer. Tragacanthæ . .	gr. x.	0·65 Gm.

Fiat massa. Divide in pilulas xx. Consperga pulvero cinnamomi.

Sig. 'One pill to be taken three times a day, between meals.'

℞

Ferri Sulphatis . . .	gr. j	0·065 Gm.
Arsenii Trioxidi . . .	gr. $\frac{1}{60}$	0·001 Gm.
Althææ	gr. ij	0·13 Gm.
Strychninæ Hydrochloridi .	gr. $\frac{1}{60}$	0·001 Gm.
Syrupi Glucosi . . .	q.s.	q.s.

Ft. pil. et mit. xxxvj.

Sig. 'One to be taken after each meal.'

℞

Ferri Redacti . . .	ʒj	4 Gm.
Glycyrrhizæ Radicis . .	ʒj	4 Gm.
Extracti Glycyrrhizæ . .	ʒj	4 Gm.
Syrupi	q.s.	q.s.

Ft. massa e qua formentur pil. LX. Obducantur saccharo.

Sig. 'Two pills to be taken three times a day, after meals.'

℞

Extracti Colchici . .	gr. ss	0·032 Gm.
Piperis Nigri . . .	gr. ss	0·032 Gm.
Rhei Radicis . . .	gr. j	0·065 Gm.

Ft. pil. M. t. p. xij. Obduc. gelatino.

Sig. 'One pill to be taken three times a day, between meals.'

℞

Picrotoxini	gr. $\frac{1}{5}$	0·013 Gm.
Atropinæ Sulphatis . .	gr. $\frac{1}{20}$	0·0032 Gm.
Sacchari Lactis . . .	gr. xx	1·3 Gm.
Extracti Malti . . .	gr. iv	0·26 Gm.

Ft. mass. et div. in pil. xx.

Sig. 'One pill to be taken night and morning.'

℞

Extracti Cannabis Indicæ .	gr. j	0·065 Gm.
Glycyrrhizæ Radicis . .	gr. j	0·065 Gm.

Ft. pil. Mitte vj.

Sig. 'One to be taken every evening at bedtime.'

℞

Quininæ Sulphatis . .	ʒij	7·5 Gm.
Acidi Tartarici . . .	gr. iv	0·25 Gm.
Tragacanthæ . . .	gr. iv	0·25 Gm.
Glycerini	gr. xvj	1·0 Gm.

Ft. massa. Div. in pil. xxx.

Sig. 'One to be taken every evening.'

℞

Creosoti	♏j	0·06 Cc.
Farinæ Tritici	gr. iij	0·2 Gm.
Syrupi Glucosi	q.s.	q.s.

Ft. pil. et obduc. gelat. M. t. p. xx.

Sig. 'One to be taken three times a day, after meals.'

℞

Creosoti	♏j	0·06 Cc.
Glycyrrh. Radic. . . .	gr. ij	0·13 Gm.
Sapon. Duri	gr. j	0·065 Gm.
Glycerini et Aq.	q.s.	q.s.

Ft. pil. M. t. p. xxxvj.

Sig. 'One to be taken after each meal.'

℞

Hydrarg. Subchlorid. . .	gr. ij	0·13 Gm.
Mannæ	gr. ij	0·13 Gm.

Ft. pil. Mitte iij.

Sig. 'One to be taken at bedtime.'

℞

Hydrarg. Subchlorid. . .	gr. vj	0·4 Gm.
Scammoniæ Resinæ . .	gr. xij	0·8 Gm.
Olei Carui	♏iv	0·25 Cc.

Ft. mass. Div. in pil. vj.

Sig. 'One to be taken when required.'

℞

Pil. Hydrargyri	gr. ij	0·13 Gm.
Pil. Rhei Co.	gr. ij	0·13 Gm.
Ext. Hyoscyami	gr. j	0·065 Gm.

Ft. pil. Mitte xij.

Sig. 'One to be taken every evening.'

℞

Podophylli Resinæ . . .	gr. ij	0·13 Gm.
Aloini	gr. viij	0·52 Gm.
Ext. Belladon. Alcoh. . .	gr. ij	0·13 Gm.
Ext. Nucis Vomicæ . . .	gr. ij	0·13 Gm.

Ft. massa. Div. in pil. viij.

Sig. 'One to be taken when required.'

℞

Cupri Sulphatis	gr. iij	0·2 Gm.
Opii	gr. vj	0·4 Gm.
Glycyrrhizæ Rad.	gr. xij	0·8 Gm.
Syrupi Glucosi	q.s.	q.s.

Ft. massa. Div. in pil. xij. Obduc. in salolo.

Sig. 'One pill to be taken three times a day.'

℞

Phosphori	gr. $\frac{1}{10}$	0·006 Gm.
Glycyrrhizæ Rad.	gr. xx	1·2 Gm.
Tragacanthæ	gr. j	0·06 Gm.
Glycerin. et Syrup.	q.s.	q.s.

Ft. massa. Div. in pil. x. Obduc. balsam. Tolut.

Sig. 'One to be taken four times a day.'

Tabellæ

These are for the most part small, dry, disc-shaped preparations, consisting of or containing medicinal agents. The name is variously applied in different countries, and by different authorities. The British Pharmacopœia has but one tabella, which is a small flat disc of chocolate containing $\frac{1}{100}$ grain of nitroglycerin; the German Pharmacopœia includes under 'Pastilli' various kinds of tablets and lozenges. Excluding lozenges the following varieties may be distinguished :

(i.) Compressed tablets (tabellæ compressæ).
(ii.) Chocolate tablets (tabellæ cacaotinæ).
(iii.) Tablet triturates (tabellæ triturationes).

Compressed tablets may be regarded as a pleasant and convenient method of administering powders. Almost any powder can be converted into tablet form, but whereas some drugs can be

compressed in the pure state, others need the addition of a binding material to enable them to maintain their shape. Generally these tablets are prepared on a manufacturing scale, but there is little difficulty in preparing them on a small scale, and many pharmacies are equipped with machines for this purpose.

The general method of making compressed tablets is first to obtain the drug or mixture of drugs in a finely granular condition, usually by moistening the powder with syrup, alcohol, diluted alcohol, or other suitable fluid, pressing the moistened mass through a No. 20 sieve, and allowing the granules to dry, and then compressing proper quantities (usually 2 to 5 grains) in a suitable machine. To prevent the particles of powder adhering to the die, a lubricant—liquid petroleum, vaseline, cacao butter, French chalk, boric acid—is often employed. Very little of such substance is used, but the quantity is sufficient to induce turbidity of a solution when the tablet, if soluble, is dissolved in water.

Speaking generally, soluble crystalline substances can be compressed into tablets without any excipient; non-crystalline substances often require the addition of sugar or similar binding agent, and insoluble powders need a disintegrating agent—dried starch, which acts in virtue of its being hygroscopic, or a mixture of sodium bicarbonate and citric or tartaric acid, is commonly used.

Drugs which owing to their physical properties could not be conveniently prescribed as powders should not be prescribed as compressed tablets. Thus deliquescent substances should not be prescribed in this way, and even effervescent and hygroscopic substances are better avoided. Resins and resinous compounds should not be prescribed

alone as compressed tablets, because, although easily compressed into this form, they do not disintegrate owing to their insolubility, and may pass out in the motions almost unchanged.

Small doses of drugs should be ordered with sugar or milk sugar as an excipient. Minim doses or less of liquids may be prescribed in a similar way, but it is questionable if such an expedient is ever necessary.

Compressed tablets possess no advantages from a physician's point of view; they are merely a convenience to the patient. They are convenient to carry, and nauseous drugs can be easily taken in this form. Each tablet should dissolve or disintegrate readily when added to water (or, rarely, to very dilute alkali or acid). In prescribing them the choice of a binding agent, if necessary, should be left to the dispenser.

Chocolate tablets are useful preparations for prescribing small doses of drugs in a palatable and portable form. They are especially valuable for explosive substances (*e.g.*, nitroglycerin) soluble in oil of theobroma. Liquids insoluble in this fat unless the dose is very small, should not be prescribed in this form, but almost any dry powder can be so prescribed. The substance is mixed with or dissolved in a suitable quantity of cacao-butter, and with this is incorporated the chocolate. The mass is rolled out to a uniform thin flat cake, which is divided into the proper number of squares and dried. Or the tablets may be made from the mass by means of a compressed tablet machine.

When these tablets are large in size they are usually termed lozenges.

Tablet triturates are light, thick tablets, usually prepared in a mould. They consist of a medicinal substance mixed with finely powdered sugar, milk sugar, kaolin, or other suitable diluent, and moistened with alcohol, water, or a mixture of the two, moulded and dried. The choice of a proper moistening agent is of importance; it should have a slight, but only a slight, solvent action on the dry powder, otherwise a hard tablet may result. Sugar tends to give a harder tablet than milk sugar. The chief advantage possessed by these preparations is their rapid disintegration, and they may be prescribed when such is desired; but the advantage over a suitably prepared compressed tablet is, except in rare instances, very slight.

Small sugar tablets or balls are sometimes medicated by soaking them in an alcoholic tincture or alcoholic solution of a drug. They have been termed rotulæ, tablet saturations, etc. They are very little used, except by homœopathic practitioners.

Hypodermic tablets (Tabellæ hypodermicæ) are generally small compressed tablets. Besides the active ingredient they should contain sufficient sodium chloride to produce an approximately isotonic solution, and a small quantity of sodium bicarbonate and tartaric acid to ensure rapid solution. Formulæ for hypodermic tablets are, however, rarely, if ever, prescribed.

Ophthalmic discs (Lamellæ ophthalmicæ) are small discs of a glycerinated gelatin containing a small quantity of an active medicament. They are very troublesome to prepare on a small scale, and if discs other than those in common use are required time should be given for them to be made by a firm constantly manufacturing such preparations.

Examples

℞

Quininæ Sulphatis . .	gr. v	0·3 Gm.

Ft. tabella compressa. M. t. 100.

Sig. 'One to be taken daily.'

℞

Pulv. Ipecac. Co. . .	gr. v	0·3 Gm.

Ft. tab. compress. M. t. tab. xij.

Sig. 'Two to be taken at bedtime as directed.'

℞

Phenacetini . . .	gr. v	0·3 Gm.
Caffeinæ	gr. ss.	0·03 Gm.
Sodii Bicarbon. . . .	gr. ij	0·13 Gm.

Ft. tab. compress. Mitte xxiv.

Sig. 'One to be taken morning and evening.'

℞

Aloini	gr. j	0·065 Gm.
Hydrarg. Subchlor. . .	gr. j	0·065 Gm.
Zingiberis	gr. ij	0·13 Gm.

Ft. tab. compress. M. t. xij.

Sig. 'One to be taken every evening.'

℞

Erythrol. Tetranit. . .	gr. ss.	0·03 Gm.

Ft. tabella cacaotina. M. t. xxiv.

Sig. 'One to be taken every six hours.'

℞

Morphinæ Hydroch. . .	gr. ij	0·13 Gm.
Sacchari	ʒij	8·0 Gm.
Ol. Cinnamomi . . .	♏j	0·06 Cc.
Alcohol.	q.s.	q.s.

Ft. massa. Div. in tab. tritur. xxiv.

Sig. 'One to be taken every eight hours when required.'

Capsulæ

Empty capsules are cases of a digestible material capable of being filled with drugs. They are usually made of rice-paper or gelatin.

Rice-paper capsules, or *cachets* (capsulæ amylaceæ), as they are usually termed, are only adapted

for dry powders. They afford a convenient method of taking nauseating powders or powders in bulk; but powders which deliquesce or otherwise change in the air should not be prescribed in this form. The capsules are made in various sizes—up to those intended to hold about 30 grains (2 grammes) of a powder of average density—and are quickly dispensed. They are rapidly disintegrated in the stomach, and consequently no delay in the action of the drug occurs. Before being swallowed they should be dipped for a moment in tepid water.

Gelatin capsules are hard or soft.

Soft gelatin capsules (capsulæ gelatinosæ elasticæ) are adapted for oily and spirituous fluids. As water softens the gelatin they cannot be used for aqueous preparations. They are made in various sizes up to very large ones to introduce into the vagina. For administration by the mouth not more than 15 minims (1 Cc.) of fluid should be ordered in one capsule; some patients find the larger sizes difficult to swallow, and a sensation of having stuck in the throat is experienced. Capsules containing creosote, copaiba, and similar substances are sold commercially (capsulæ gelatinosæ elasticæ repletæ or simply capsulæ repletæ). These are somewhat better finished than those made by the pharmacist, and occasionally can be obtained smaller in size; but therapeutically they possess no advantages. Filled capsules containing 1 minim can be bought, but in prescribing capsules to be made not less than 3 to 5 minims should be allowed for each capsule. If the dose of the drug is less

than this, the drug should be dissolved in oil or other non-aqueous solvent.

Hard gelatin capsules (capsulæ gelatinosæ duræ operculatæ or capsulæ operculatæ) are adapted for non-aqueous fluids and for powders. They are more easily and quickly filled, but are less pleasant to swallow than soft gelatin capsules. A variety of sizes can be obtained, and since they can be sealed without being filled even a small drop of liquid can be dispensed in them. They take somewhat longer to digest than soft capsules, but the difference is not great.

Glutoid capsules (capsulæ glutoidales), which are gelatin capsules hardened with formalin, were introduced by Professor Sahli to delay the disintegration of the medicament. Three grades of hardening were adopted: the weakest resist pepsin digestion $1\frac{1}{2}$ hour, and pancreatic digestion 1 to $1\frac{1}{2}$ hour; the medium resist pepsin digestion 7 hours, pancreatic digestion 2 to $2\frac{1}{2}$ hours; the hardest resist pepsin digestion 12 hours, pancreatic digestion $2\frac{1}{2}$ to $3\frac{1}{2}$ hours. The capsules have been employed therapeutically to avoid the action of the gastric juice on medicines and the action of medicines on the stomach. Copaiba, calomel, oleo-resin of male fern, salol, β-naphthol, and others have been given in this way.

Keratin capsules (capsulæ keratinosæ), which also resist the action of the gastric juice, can be obtained.

Glass capsules (capsulæ vitreæ, vaporoles) are used for volatile liquids intended to be inhaled. The capsule, which contains one dose, is broken in a handkerchief or similar article and held to the mouth. Inhalation is continued as long as necessary. Capsules of amyl nitrite (5 minims in each) are used in this manner. Glass capsules containing other ingredients (chloroform, carbolic acid, etc.) may be prepared, but there is little advantage, except a certain convenience for the patient, in prescribing drugs in this way.

Examples

℞
Quininæ Sulphatis . . gr. v 0·3 Gm.
Ft. pulv. Detur in capsula amylacea. Mitte tales capsulas no. xxiv.

Sig. 'One to be taken every evening.'

℞
Carbonis Ligni . . . ʒij 8 Gm.
Ft. pulv. Divide in part. æq. xij et pone in capsulas amylaceas.

Sig. 'One to be taken an hour after each meal.'

℞

Pulv. Rhei Radic. . . .	gr. x	0·65 Gm.
Magnesiæ	gr. x	0·65 Gm.
Spir. Cinnamom. . . .	♏ij	0·12 Cc.

Ft. pulv. Det. in caps. amyl. M. t. c. xvj.

Sig. 'One to be taken three times a day, after meals.'

℞

Morphinæ Hydroch. . .	gr. $\frac{1}{12}$	0·005 Gm.
Camphoræ	gr. ij	0·13 Gm.
Sacchar. Lactis . . .	gr. iv.	0·26 Gm.

Ft. pulv. D. in cap. amyl. Mitte xij.

Sig. 'One to be taken night and morning.'

℞

Creosoti	♏j	0·06 Cc.
Olei Morrhuæ	♏iv	0·25 Cc.

Ft. sol. Pone in caps. gel. flex. M. t. c. xxiv.

Sig. 'One to be taken after each meal.'

℞
Ext. Filicis Liq. B.P. . . ʒj 3·5 Cc.
[Oleores. Aspidii U.S.P.]
Det. in caps. gel. flex. quatuor.

Sig. 'To be taken as directed.'

℞

Copaibæ
Saloli . . . . āā gr. v āā 0·3 Gm.
Det. in caps. gel. operc. M. t. c. xij.

Sig. 'One to be taken three times a day, an hour after food.'

℞

Guaiacol.
Olei Morrhuæ . . āā ♏iij āā 0·2 Cc.
Detur caps. replet. M. t. xx.

Sig. 'One to be taken three times a day, after meals.'

Electuaria—Gelatinæ

Electuaries are mixtures of thick pasty consistence intended for internal administration. They generally consist of an insoluble powder mixed with syrup, honey, fruit pulp, or glycerin, rarely with some other fluid or semi-solid. They are agreeable preparations to give to children, but as it is more convenient to order the powder and give directions for its admixture with some sweet fluid they are not much prescribed.

For most powders the following proportions will be found to give approximately the proper consistence :

1	part	powder to	1 or 2	parts	syrup.
1	,,	,,	2 or 3	,,	honey.
1	,,	,,	4 or 5	,,	fruit pulp.
1	,,	,,	1 or 2	,,	oleaginous substances.

The confections of sulphur and senna, both of which are official, are most largely used.

Examples

℞

Ipecacuanhæ Radicis .	. gr. vj	0·4 Gm.
Tinct. Camphoræ Co. .	. ʒij	7·5 Cc.
Amygdalæ Dulcis .	. ℥iss	45·0 Gm.
Syrupi Tolutani . .	. ℥iss	45·0 Cc.

Ft. confect. Detur in olla.

Sig. 'One teaspoonful to be taken every four hours.'

℞

Pulv. Cubebæ		
Copaibæ . . .	āā ʒj	30·0 Gm.
Glusidi	. gr. x	0·65 Gm.
Ol. Menth. Pip. . .	. ♏x	0·6 Cc.

Ft. electuar.

Sig. 'Half a teaspoonful to be taken three times a day, after food.'

Gelatinæ.—Jellies as medicinal forms for internal administration are less frequently prescribed than they deserve to be. They are easily made, are elegant in appearance, are readily disintegrated in the stomach, and in virtue of their colloidal nature tend to diminish the taste of nauseating drugs. They do not keep well, however, and take some hours to prepare. If desired clear they must be filtered or otherwise clarified.

The proportion of gelatin required is about 4 per cent. If glycerin is present 5 to 6 per cent. or even more may be necessary. The jelly should be flavoured and may often be coloured with advantage. Substances incompatible with gelatin (page 97) should not be prescribed in this form.

Examples

℞

Atropinæ Sulphatis . .	gr. $\frac{1}{10}$	6·5 Mgm.
Codeinæ Phosphatis . .	gr. viij	0·5 Gm.
Gelatini	ʒij	8·0 Gm.
Glycerini	℥ss	15·0 Cc.
Aquæ Rosæ	℥iiiss	100·0 Cc.
Tincturæ Cocci . . .	♏x	0·6 Cc.
Fiat gelatina		

Sig. 'One teaspoonful to be taken at bedtime.'

℞

Olei Morrhuæ	℥iv	120 Cc.
Gelatini	ʒiij	12 Gm.
Syrupi	℥iij	90 Cc.
Aq. Cinnamomi . . .	℥iij	90 Cc.
Ft. gelat.		

Sig. 'A dessertspoonful to be taken after each meal.'

Trochisci—Pastilli

Lozenges, or troches, are dry tablets consisting mainly of sugar. As heat is injurious to many drugs, medicated lozenges should be prepared without heating, and hence a binding agent—a mucilaginous or albuminous substance—is necessary to unite the particles of sugar. Gum acacia is mostly used, but tragacanth, white of egg, or gelatin jelly may be employed. The last-named substances produce a more friable lozenge than gum acacia. The proportions of these ingredients depend upon the quantity and character of the active medicine present, but they may vary considerably and a good lozenge be produced. If the active substance does not exceed 10 per cent., the lozenge may contain of sugar (finely powdered) 70 to 85 per cent.;

of tragacanth 2 to 4 per cent. or gum acacia 5 to 10 per cent.; of water 5 to 28 per cent. Extract of liquorice, fruit jelly, etc., may replace part of these ingredients. Lozenges should not weigh more than 15 to 20 grains (1 to $1\frac{1}{4}$ gramme).

Examples

℞

Bismuth. Carb. . . .		gr. ij		0·13 Gm.
Sodii Bicarb. . . .		gr. j		0·065 Gm.
Sacchari		gr. x		0·65 Gm.
Tragacanthæ . . .		gr. $\frac{1}{4}$		0·016 Gm.
Aq. Menth. Pip. . . .		q.s.		q.s.

Ft. troch. M. t. 100.

Sig. 'Two or three to be taken three times a day when required.'

℞

Hydrarg. Subchlor. . .		gr. j		0·065 Gm.
Sacchari				
Sacch. Lactis . .	āā	gr. iij	āā	0·2 Gm.
Acaciæ Gummi . . .		gr. j		0·065 Gm.
Aq. Rosæ		q.s.		q.s.

Ft. troch. M. t. xxiv.

Sig. 'One to be taken every evening.'

Pastilles (jujubes) consist of a mucilaginous or gelatinous base, or of both combined. For therapeutical purposes a gum-glycerin-gelatin base is most generally useful. Glycerin, apart from its action on mucous membranes, prevents evaporation and hence hardening of the jujube. The greater the proportion of glycerin present, the less, *ceteris paribus*, is the consistence of the jujube. Gum acacia, on the other hand, tends to increase the consistence of the jujube and make it more demulcent. The quantity of gelatin, however, is

of greatest importance; about 20 per cent. is the proportion most commonly used. This gives a pastille of rather stiff consistence unless a large proportion of glycerin is present. Less than 10 per cent. gelatin should not be prescribed (unless gum is the chief basis), and it is inadvisable to exceed 40 per cent. The following formulæ make satisfactory pastilles:

Gelatin	20	Gelatin	25
Glycerin	40	Glycerin	50
Syrup	20	Water	35
Mucilage	30	Evaporate to 100 parts.	
Evaporate to 100 parts.			

Chocolate forms a good basis for administering some medicines to children, but it is more difficult for unpractised hands to turn out elegant chocolates than good lozenges. A chocolate base is most useful for substances soluble in fatty media. Such substances can be incorporated with oil of theobroma and the mixture impregnated with cocoa and sugar.

Examples

℞

Santonini	gr. j.	0·065	Gm.
Pulv. Cacao.	gr. ij	0·13	Gm.
Sacchari	gr. ij	0·13	Gm.
Ol. Theobromat.	gr. iij	0·2	Gm.

Ft. troch. M. t. iv.

Sig. 'One to be taken every other evening as directed.'

Various other medicated sweetmeats can be prepared or obtained, or have been suggested, but they are not of sufficient importance to be considered here.

℞
Kino
Ol. Theobrom.
Pulv. Cacao. . . āā iij gr. āā 0·2 Gm.
Sacchari . . . . gr. vj 0·4 Gm.
Ft. troch. M. t. xxiv.

Sig. 'One to be taken after each meal.'

Suppositoria

Suppositories are solid or semi-solid preparations for introducing into mucous cavities other than the mouth. Unless otherwise specified the name implies suppositories for the rectum.

Suppositories vary in size and shape according to the part to which they are to be applied. Their shape must be such as will allow of their easy introduction and subsequent retention in the cavity; and their size such as is suitable to the capacity of the cavity into which they are to be placed. The size may also vary (*e.g.*, in the case of the urethra) according to the extent of the mucous surface it is desired to influence.

The **excipient** must be such as will dissolve in the mucous secretions of the body or will melt below the temperature of the body. Various excipients have been suggested, but three only—oil of theobroma, glycerinated gelatin, and curd (stearin) soap—are in common use, and are the only ones required.

Oil of theobroma (cacao-butter) is the most generally useful. It is solid at ordinary temperatures, begins to soften at 79° F. (26° C.), and melts between 88° and 93° F. (31° and 34° C.). It has an agreeable odour and bland action, and is very stable.

Its influence upon the action and absorption of medicaments is similar to that of any other fixed oil or fat (*cf.* partition coefficient theory, page 21), and should be well understood: it will often prove of value in practice. Thus the question whether an alkaloid or its salt should be prescribed with oil of theobroma may arise. The alkaloid is soluble in the oil of theobroma and only slightly soluble in the mucous secretion, whereas the alkaloidal salt is insoluble in the oil of theobroma and probably readily soluble in the mucous secretion. In the first case the local action of the drug would be slight but prolonged, and absorption slow; in the second the local action would be more intense, and absorption quicker. For these and other reasons an alkaloidal salt is generally to be preferred to the alkaloid in prescribing suppositories.

Oil of theobroma is almost of universal applicability as a suppository excipient, but in the case of some drugs it requires modification. Drugs which dissolve in it (volatile oils, carbolic acid, creosote, chloral hydrate, etc.) generally lower the melting point, and the suppository may be too soft at ordinary temperatures to permit of the necessary manipulation in administration. To overcome this a small amount of wax or spermaceti must be added. The quantity, however, should not be such as will raise the melting point of the mixture above that of the temperature of the body. A mixture of oil of theobroma 8, white wax 2, becomes soft but does not liquefy at the normal temperature of the body, consequently this quantity of wax should not be exceeded.

Substances administered as suppositories which raise the melting point of oil of theobroma are relatively few. Apart from hard paraffin, waxes, etc., which are employed for the purpose, salts of heavy metals may raise the melting point. This is probably due to the fact that the suppositories as commonly dispensed contain a small quantity of water; double decomposition occurs and a variable quantity of an insoluble soap is formed. Such substances should be used in an anhydrous state, and water should not be employed to dissolve or triturate them.

Insoluble powders do not, even in considerable quantity, distinctly affect the melting point of oil of theobroma; nevertheless it is advisable, if large quantities of powder (above 20 per cent.) are being ordered, to add a little castor oil or wool-fat to the prescription. This often ensures better suppositories and aids distribution after administration.

Soluble solids are best triturated with, or if very soluble dissolved in, water or alcohol before mixing with the oil of theobroma, unless the substance is a readily soluble salt of a heavy metal, when it is better treated as an insoluble powder—*i.e.*, without the addition of water. This method of dissolving a portion or the whole of a soluble powder gives a smoother suppository and, in many cases, one better adapted for therapeutic use. Extracts are treated in a similar manner; aqueous extracts are rubbed up with water to a cream, and alcoholic extracts with alcohol, previous to incorporating with the oil of theobroma. In cases where water is used lanolin or soap is generally a valuable addition to the

cacao-butter base. Glycerin is sometimes a useful solvent for the active ingredients of suppositories.

The suppositories may be made (i.) by pounding the active ingredient with grated oil of theobroma to a uniform mass and afterwards cutting and moulding to the proper size and shape; or (ii.) by melting the oil of theobroma before mixing with the active ingredient and pouring the mixture when of proper consistence into well cooled moulds (page 279). Generally either method may be used with success, but occasionally (*e.g.*, for chloral hydrate suppositories) the cold method is best. In such cases it is advisable to indicate the method on the prescription.

Glycerinated gelatin as a suppository excipient has come into favour of late years. It possesses the advantage of being miscible with aqueous solutions, and hence with the mucous secretions; it can be made of almost any desired consistence, and the local action of drugs contained in it can in this way be more conveniently regulated than in an oil of theobroma basis. It has the disadvantages of being less agreeable to the patient in some cases (vaginal suppositories made with it are liable to mat the pubic hairs, and urethral suppositories are occasionally difficult to introduce), and of being more troublesome to prepare and to keep, than oil of theobroma suppositories.

The excipient consists of glycerin and gelatin and usually water in varying proportions according to the action required. If no water is present the irritant action of glycerin is obtained; the more gelatin present, the slower is the solution of the suppository, and consequently the more prolonged

its effects. Glycerin diminishes the gelatinising power of gelatin when mixed with it. Gum acacia (and other gums) increases the consistence of glycerinated gelatin.

The following four formulæ are given as types. The first two contain practically no water, and hence the action of glycerin is obtained; in the others a sufficient quantity of water is present to annul the irritant action of the glycerin.

Soft basis		*Tough basis*	
I		II	
Gelatin . . .	1	Gelatin . . .	2
Glycerin . . .	2	Glycerin . . .	3
Water . . .	q.s.	Water . . .	q.s.
To make 3 parts.		To make 5 parts.	
III		IV	
Gelatin . . .	1	Gelatin . . .	$1\frac{1}{2}$
Glycerin . . .	2	Glycerin . . .	2
Water . . .	2	Mucilage of Acacia .	2
To make 5 parts.		To make $5\frac{1}{2}$ parts.	

For most purposes a formula similar to Formula III. is best. In the case of astringent substances which precipitate gelatin in aqueous solution Formula I. or II. should be used; and these formulæ are better adapted for hygroscopic substances than Formula III. or IV. If much insoluble powder is to be incorporated, less glycerin and more water than are present in Formula III. are advised—*e.g.*, gelatin 1, glycerin 1 (or even $\frac{1}{2}$), water 3.

The United States Pharmacopœia contains a glycerinated gelatin, consisting of glycerin and gelatin in equal proportions,

which forms a convenient base for the exhibition of remedies as suppositories. The remedies are mixed with water and incorporated with the melted base. The glycerin suppository of the British Pharmacopœia contains 70 per cent. of glycerin, nearly 14 per cent. of gelatin, and 16 per cent. of water. It is not intended to be used as a basis for other suppositories.

The glycerinated gelatin base is suitable for most substances soluble in water or glycerin and for insoluble powders. It is not well adapted for oleaginous liquids or for substances incompatible with gelatin (page 97), unless these are soluble in glycerin, when a water-free base may be used.

In preparing glycerinated gelatin heat and water are necessary; the water to swell the gelatin and the heat to form the solution subsequently. The water, after the addition of glycerin, may be evaporated off, in which case, as gelatin decomposes on prolonged heating in presence of water, the minimal quantity should be employed. The drug may be added at the end of the process while the solution is still hot, or if soluble in water or glycerin it may be added earlier. In either case it is obvious that this basis is not adapted for easily volatile substances.

Soap is often a useful suppository basis if its irritant action is not objectionable. This in the case of curd soap (sapo animalis—mainly sodium stearate) is relatively slight, and owing to this and to its greater consistence it is the best soap to use as a suppository excipient. The use of soap, however, for this purpose is limited; it should only be employed as an adjuvant vehicle when a local irritant action is required; and unfortunately with many

substances of this class it is incompatible (page 105). It finds its chief use (apart from its use alone) as a vehicle for glycerin, which it is able to take up in large quantity. The glycerin suppository of the United States Pharmacopœia is made with a sodium stearate basis. It contains about 85 per cent. of glycerin.

Suppository Capsules.—Empty capsules of various sizes and shapes, consisting of a thick shell of cacao-butter (glumæ suppositoriæ cacaotinæ) or a thin shell of gelatin (glumæ suppositoriæ gelatinosæ), are sometimes used, especially on the Continent, for the preparation of suppositories. In the case of the cacao-butter suppositories the active drug is usually first mixed with sufficient cacao-butter to form a paste which will fill the capsule, and the suppository is then closed by inserting the cacao-butter stopper and sealing if necessary with the aid of heat. The gelatin capsules are filled and sealed like those intended to be taken by the mouth (page 283). Neither kind of capsule can be recommended from a prescriber's point of view, but of the two the cacao-butter capsules are the better. Even with these the thick shell of cacao-butter must be melted and disseminated before the action of the medicament can begin; and it is obvious that the concentration of the drug in the paste filling the cavity and any local action it may exert must be greater than it would be if mixed with the whole of the oil of theobroma forming the suppository. These shapes have been especially recommended for substances (ichthyol, etc.) which do not mix well with oil of theobroma.

Varieties of suppositories.—Apart from the basis used in their preparation suppositories are conveniently divided according to the cavity into which they are to be introduced.

Rectal suppositories (suppositoria analia, or simply suppositoria) are generally bullet- or cone-shaped, and weigh from 15 to 45 grains (1 to

3 grammes) if made of oil of theobroma, and 30 to 120 grains (2 to 8 grammes) if made of glycerinated gelatin. The British Pharmacopœia requires all suppositories made with oil of theobroma to weigh 15 grains (1 gramme); the United States Pharmacopœia recommends that such suppositories should weigh 30 grains (2 grammes); the German Pharmacopœia advises 2 to 3 grammes. The glycerinated gelatin suppositories owing to their greater density should weigh double as much.

Suppositories are introduced into the rectum to produce a local action or to be absorbed. The latter class of suppositories may contain drugs intended to produce a general action or nutritive substances. As the author has no faith in nutrient suppositories, they will not be considered here (*cf.* rectum, page 35). With regard to the dose of drugs intended to be absorbed, this should be approximately the same as that which would be given for a single administration by the mouth. In some cases it may be more ($1\frac{1}{2}$ times has been given as a guide); it should rarely be less. The drug most commonly given in suppositories for a general effect is morphine (usually as a salt), but almost any pure principle, which is soluble in water and which has not a local irritant action, may be administered in this form. Substances intended to have a local action on the rectal mucous membrane are astringent, sedative, antiseptic, or irritant. Irritant substances, excepting glycerin and soap, can rarely, if ever, be required. The astringents used are tannin and preparations of tannin-containing drugs and metallic astringents (silver nitrate, copper sulphate, lead

acetate, etc.). The sedatives are cocaine and its salts and allied drugs, belladonna and its alkaloids, and insoluble powders. The antiseptics used are boric acid, carbolic acid, resorcin, mercuric salts, quinine salts, and the newer synthetic remedies.

The following quantities of drugs may be given in each suppository: Acidum Carbolicum (1 to $1\frac{1}{2}$ grains), Acidum Tannicum (3 to 5 grains), Acidum Boricum (4 to 8 grains), Alumen (3 to 5 grains), Argenti Nitras ($\frac{1}{2}$ to 1 grain), Atropina ($\frac{1}{80}$ to $\frac{1}{40}$ grain), Balsam. Peruv. (3 to 5 grains), Bismuthi Subnitras (4 to 8 grains), Borax (4 to 8 grains), Cocaina ($\frac{1}{4}$ to $\frac{1}{2}$ grain), Cupri Sulphas (1 to 3 grains), Hydrargyri Perchloridum ($\frac{1}{20}$ to $\frac{1}{10}$ grain), Iodoformum (3 to 5 grains), Morphinæ Hydrochloridum ($\frac{1}{4}$ grain), Opium (1 to 3 grains), Plumbi Acetas (2 to 4 grains), Quininæ Hydrochloridum (3 to 5 grains), Zinci Sulphas (2 to 4 grains).

Vaginal suppositories (suppositoria vaginalia), or, as they are often termed, pessaries (*pessus, i,* m.), are ovoid or spherical in form and usually weigh 45 to 60 grains (3 to 4 grammes) if made of cacao-butter, and 90 to 150 grains (6 to 10 grammes) if made of glycerinated gelatin. The United States Pharmacopœia recommends 4 grammes for the former and 10 grammes for the latter.

The quantity of active medicament intended to exert a local action should be about three times that for a rectal suppository.

Urethral suppositories (suppositoria urethralia) or bougies (bacilla, bougiæ, cereoli) are pencil-shaped, pointed at one extremity, from 2 to 6 inches (5 to 15 cm.) in length and $\frac{1}{8}$ to $\frac{3}{16}$ inch (3 to 5 mm.) in diameter. The United States Pharmacopœia says they should be either 7 cm. or 14 cm. in length. If

made with glycerinated gelatin the former should weigh about 2 grammes and the latter about 4 grammes; if prepared with oil of theobroma they should weigh about half these amounts.

The quantity of medicament to be added to a urethral suppository should be half to three-quarters of the amount used for a rectal suppository.

Nasal suppositories (suppositoria nasalia) or bougies (buginaria) are also pencil-shaped, but are shorter and thicker than urethral suppositories. They should contain one-quarter to one-third the quantity of medicament used in a rectal suppository, except in the case of astringent substances, when one-eighth to one-sixth is sufficient. They are little used.

Aural suppositories (suppositoria auricularia) are also rarely used. They are generally almond- or bullet-shaped and weigh 5 to 10 grains (0·35 to 0·7 gramme). The quantity of medicament may be one-quarter to half that given in rectal suppositories.

Salve-sounds are zinc probes or sounds covered with a cacao-butter basis (Ol. Theobromatis 100, Cera Flava 2, Balsamum Peruvianum 2) containing the desired medicament. They are used to introduce into the urethra, and are left in position until the cacao-butter vehicle has melted.

Antrophores (antrophori) consist of a flexible metal spiral covered with a glycerinated gelatin basis containing the active drug. They are defined in the German Pharmacopœia, but cannot be easily made on a small scale. Commercial antrophores for the urethra (urethral and prostate antrophores), uterus, and nose are made. These contain tannic acid (5 to

10 per cent.), boric acid (4 per cent.), copper sulphate (0·2 to 0·5 per cent.), zinc sulphate (0·5 to 1 per cent.), iodoform (5 to 30 per cent.), resorcin (5 to 10 per cent.), etc. They do not appear to possess any noteworthy advantages over suppositories or salve-sounds, and are not much used in this country.

When dispensed suppositories should have a smooth surface and be uniform in shape, size, and consistence; the medicament should be uniformly distributed through the mass, and its individual particles should not be visible to the naked eye. Oil of theobroma suppositories are best sent out protected with cotton-wool in boxes; they may be enclosed in tinfoil or paraffin, but if so directions should be given for the removal of the case previous to administration. Glycerinated gelatin suppositories, especially those containing a large percentage of glycerin, should be sent out in stoppered bottles or enclosed in glass or paraffin cases.

Examples

℞

Argenti Nitratis	gr. j	0·065 Gm.
Olei Ricini	gtt. ij	gtt. ij
Olei Theobromatis . .	gr. xiij	0·85 Gm.

Ft. suppos. anal. Mitte vj.

Sig. 'One to be administered every evening as directed.'

℞

Cocainæ Hydrochlor. . .	gr. ss	0·03 Gm.
Aquæ Destillatæ . . .	♏j	0·06 Cc.
Olei Theobromatis . .	gr. xiv	0·9 Gm.

Ft. suppos. anal. Mitte vj.

Sig. 'One to be introduced morning and evening.'

℞

Morphinæ Hydrochlor. .	gr. $\frac{1}{6}$	0·011 Gm.
Saloli	gr. viij	0·5 Gm.
Adipis Lanæ . . .	gr. iv	0·25 Gm.
Olei Theobromatis . .	gr. xviij	1·2 Gm.

Fiat sine calore suppos. anal. M. t. s. xij.

Sig. 'One to be administered morning and evening as directed.'

℞

Ext. Belladon. Alcoh. .	gr. ix.	0·6 Gm.
Gelatini		
Glycerini . . . āā	ʒij	āā 8·0 Gm.
Aq. Destillatæ . . .	ʒiv	16·0 Gm.

Ft. gel. sec. art. Div. in suppos. anal. vj.

Sig. 'One to be used as directed every evening.'

℞

Ichthyoli	gr. vj	0·4 Gm.

Impleatur in glumas suppositorias anales cacaotinas. Mitte talia suppositoria xij.

Sig. 'One to be introduced every six hours.'

℞

Glycer. Acid. Borici . .	ʒiv	16 Gm.
Gelatini	ʒj	4 Gm.
Aquæ Destillatæ . . .	ʒj	4 Cc.

Ft. gel. e quâ suppos. anal. no. viij formentur.

Sig. 'One suppository to be administered every four hours.'

℞

Balsami Peruviani . .	gr. x	0·65 Gm.
Cetacei	gr. vj	0·4 Gm.
Olei Theobromatis . .	gr. XLV	3·0 Gm.

Ft. suppos. vagin. M. t. s. xij.

Sig. 'One to be applied as directed every four hours.'

℞

Bismuth. Subnitrat. .	gr. v	0·32 Gm.
Resorcini . . .	gr. ij	0·13 Gm.
Gelatini		
Glycerini . .	āā gr. viiss	āā 0·5 Gm.
Aq. Destil. . . .	gr. xv	1·0 Gm.

Ft. suppos. ureth. Mitte vj.

Sig. 'To be used as directed.'

Unguenta

Ointments are semi-solid preparations for external application, consisting of fatty, waxy, or paraffin vehicles with or without other medicinal agents.

Cerates (cerata) are stiff ointments containing wax.

Ointments are employed (i.) to protect an exposed part from the action of the air; (ii.) to soften the skin; (iii.) to produce locally the action of a medicament (usually an antiseptic, parasiticide, irritant, or astringent); (iv.) to obtain the absorption of a drug (mercury, salicylic acid, guaiacol, etc.). These various uses are dependent to some extent upon the properties of the vehicle, especially on its power of penetrating into the skin (page 225).

The vehicles in common use are lard, wool-fat, and paraffins (chiefly soft). Numerous others have been suggested but with few exceptions they have not come into general use.

Wool-fat (Adeps Lanæ) is a yellowish, somewhat translucent, unctuous substance composed chiefly of cholesterin, iso-cholesterin, and their esters (mainly palmitic and stearic). It is very tenacious,

and on this account cannot be used alone as a vehicle for ointments. It requires diluting with a fixed oil, soft paraffin, or similar substance; and water is often a valuable addition, as it diminishes the greasiness, and probably increases the penetration of the vehicle and enhances the action of medicaments contained in it. The proportions—wool-fat 20, fixed oil 4, water 5—which are those of the Unguentum Adipis Lanæ of the German Pharmacopœia, will suffice for most purposes. If a large quantity of powder is an ingredient of the ointment, more oil and water may generally be used with advantage.

Of all the ointment bases, wool-fat penetrates into the skin most quickly and with greatest ease. It is also the one most readily miscible with water: it will take up a quantity equal to its own weight. It is miscible to the same extent with glycerin, but it absorbs alcohol to a relatively slight degree (about 5 per cent.). These mixtures are merely mechanical mixtures: if the mixture with water be heated it will separate into two layers—an upper layer of wool-fat, a lower layer of water. Wool-fat is a stable substance and does not go rancid unless kept for very long periods.

Hydrous wool-fat (Adeps Lanæ Hydrosus—lanolin), which contains 30 per cent. of water, is also too tenacious for general use. It requires the addition of a fixed oil (15 to 25 per cent.).

Lard (Adeps), which for dispensing purposes should be pure, is a useful ointment base. It has a good consistence and is cheap; it takes up a certain amount of water (15 per cent.), alcohol

(20 per cent.), and glycerin (50 per cent.); and with friction it penetrates moderately well into the skin. It is, however, liable to go rancid quickly, and then becomes irritating; hence ointments made with a pure lard base only should not be kept more than a few days. To make lard more stable it is usually benzoated, but the addition of any antiseptic which dissolves in the fat will serve the same purpose. Beeswax, wool-fat, and resin also delay rancidity.

Benzoated lard, which is official, consists of pure lard impregnated with benzoin, and is largely used as an ointment base. It should not be used for eye ointments, as it is somewhat irritating to the conjunctiva.

Paraffins are extremely stable substances, but they take up relatively little water (5 per cent.) or alcohol, and they penetrate the least readily of the ointment vehicles into the skin. Soft paraffin is too soft for most purposes, hard paraffin is too hard, hence a combination of the two—the proportions of which vary according to the prevailing temperature—is official as paraffin ointment. Soft paraffin, however, is a useful vehicle for eye ointments, and for ointments containing large quantities of powder.

Pure paraffins are innocuous, but commercial paraffins sometimes contain impurities which cause irritation.

Waxes (Cera alba et flava, Cetaceum) are used to increase the consistence of fixed oils and fats. Wax 3, fixed oil 7, produce a mixture of ointment-like consistence. Such a mixture is more stable

and takes up more water than lard, but it possesses no other advantages. A larger proportion of wax produces a stiff ointment (a cerate) which in virtue of its stiffness is a better protective. Such ointments are well adapted for rubbing on the lips (lip-salves) and, under some conditions, the hands. Suet and hard paraffin may be used to increase the consistence of other ointment bases, but for most purposes beeswax or spermaceti is better.

Cold Creams.—The addition of wax to another ointment base enables this to take up more water than before, and in the case of fixed oils and fats considerable quantities of water may be incorporated. With a mixture of white wax 3 parts and almond oil 7 parts, 5 to 15 parts of water can be incorporated and a uniform and fairly permanent emulsion of ointment-like consistence produced. Such a mixture is termed a 'cold cream.' When placed on the skin the ointment feels cool because part of the water evaporates and abstracts heat from the skin for the purpose, and owing to its being an emulsion evaporation of perspiration is not prevented to the same extent as by a pure fat basis. Glycerin or alcohol, if required as a solvent, may replace half the water of a cold cream; but neither of these substances nor water can be incorporated with cold cream already prepared without reheating it. Cold cream is not, however, largely used as a vehicle. It is best adapted for substances readily soluble in water or glycerin and for aqueous liquids.

Oleic acid is of some importance owing to its property of dissolving metallic oxides and alkaloids

(and other bases) and forming oleates. Metallic oleates may be prepared by dissolving the oxide in oleic acid—an excess of acid is necessary—or by adding a solution of a soluble salt to a solution of sodium oleate and washing the precipitate. They may be used pure or diluted with an ointment base. Two (mercury oleate and zinc oleate) are official in the B.P., and one (mercury oleate) in the U.S.P. Metallic palmitates and stearates can also be prepared. Zinc stearate is official in the U.S.P. Lead oleate (lead plaster) diluted with an equal weight of olive oil forms the Unguentum Diachylon of the German Pharmacopœia; diluted with an equal weight of soft paraffin it is known as Kaposi's ointment (Unguentum Vaselini Plumbicum). The Unguentum Diachylon U.S.P. consists of lead plaster 50, oil of lavender flowers 1, olive oil 49.

Oleic acid, however, is mainly used in the preparation of alkaloidal ointments. All the official alkaloidal ointments are made by preparing first the oleate. An excess of oleic acid must be used—four times the quantity of alkaloid (not a salt) need not be exceeded.

Soap (sodium oleate or stearate), superfatted or neutral, often proves a useful addition (10 to 20 per cent.) to other ointment bases, especially if substances like balsam of Peru and tarry preparations, which do not mix well with purely fatty excipients, are to be incorporated. Soaps tend to increase the penetrability of an ointment into the skin, but they do not increase the elasticity of the skin or act as protectives to the same extent as the common ointment bases.

Various other mineral and vegetable oils, fats, and waxes have been employed in dermatological practice, and a number of ointment bases, mostly proprietary articles with distinctive names, can be obtained commercially, but few of these possess any distinctive merit. For non-fatty ointments see Pastes (page 231).

Choice of excipient. — This depends mainly upon (*a*) the position and pathological condition of the diseased part; (*b*) the characters of the remedy.

(*a*) If a purely protective action only is required, any ointment base may be used; but if penetration into the skin is necessary, a wool-fat or lard vehicle is advised. Good results may be obtained with a paraffin vehicle, but more friction is required, and the penetration is less than with the bases named. A paraffin base, however, is well adapted for a superficial action, especially on dry surfaces. If the surface is exposed, is acutely inflamed and showing much exudation, a cold cream (if an ointment form is desired) is one of the best vehicles; if the part is not exposed, any ointment vehicle with a large quantity of powder is to be preferred. Pastes are often better for this condition. For mucous and moist surfaces a wool-fat base, or, if friction can be applied, a cerate base, is most applicable; for the conjunctiva, soft paraffin is as good a base as any, since ointment bases themselves have practically no action on this tissue. (The absorption of remedies from unguent bases is dealt with under Skin, page 23.)

(*b*) Remedies may determine the choice of an excipient in virtue of their physical condition or their miscibility or immiscibility with the different bases. Fortunately most substances are or can be made miscible with most ointment bases, and difficulties comparatively rarely arise, but trouble is sometimes experienced with thick liquids of a tarry or balsamic nature.

Solids when incorporated with an ointment vehicle, should be in the finest state of powder. Powdering, if necessary, is effected by trituration, but in the case of unctuous or resinous substances the addition of alcohol, glycerin, or other medium is necessary to produce a sufficiently fine state of division. If the quantity of active drug is relatively small and is readily soluble in a liquid medium, a smoother ointment can often be prepared by adding sufficient of such a solvent to the prescription. Thus alkaloids (not their salts), although soluble to some extent in fats, are usually converted into oleates by dissolving them in oleic acid before incorporating with the fatty base (see page 223); and substances readily soluble in water may be dissolved in this before mixing with the excipient. These points are worthy of remembrance in the choice of an ointment vehicle.

Dry powders can be incorporated with any vehicle. About 20 per cent. may be added without affecting injuriously the consistence of the ointment. Large quantities (40 per cent.) make a very stiff ointment, or, as it is then termed, paste (see page 229).

Liquids prescribed in ointments may be divided into (i.) those soluble, and (ii.) those insoluble in the

ointment base. The former diminish the consistence of the ointment base considerably; the latter affect it to a relatively slight degree. Hence if a quantity of a liquid soluble in an ointment base is to be incorporated, a stiff base (wool-fat or a cerate) should be chosen, or sufficient wax or spermaceti added to give the mixture the necessary consistence. For moderate quantities of liquids (usually aqueous solutions) insoluble in an ointment base, wool-fat is the best excipient. A small quantity of fixed oil should be added, as this produces a smoother ointment and better emulsion. For larger quantities of aqueous solutions a waxy base is advisable (see Cold-creams, page 223). Soap increases the miscibility of water and fats, but it is less powerful than wax. Solutions of salts are less miscible than water with ointment bases, but if salts are present soap should not be employed.

Ointments are usually sent out in white or coloured pots or jars (ollæ albæ, etc.) according to the quantity ordered. They can also be dispensed in metal tubes (tubæ stanneæ) like those used for oil paints. For poor patients chip boxes should be ordered.

Examples

℞

Resorcini		gr. xx	1·3 Gm.
Olei Amygdal. Exp.			
Aquæ Rosæ . .	āā	ʒij	āā 8·0 Cc.
Adipis Lanæ		℥iss	42·0 Gm.

Ft. ung. Det. in olla alba.

Sig. 'To be rubbed into the affected parts night and morning.'

℞

Camphoræ	gr. xx	1·0 Gm.
Acid. Carbol. . . .	gr. x	0·5 Gm.
Ung. Paraffini . . .	℥ij	50·0 Gm.
Ft. ung.		

Sig. 'To be applied daily, spread upon lint.'

℞

Plumbi Acetatis . . .	gr. xx	1 Gm.
Ung. Aquæ Rosæ . .	℥ij	50 Gm.
Ft. ung.		

Sig. 'To be applied on lint night and morning.'

℞

Acid. Salicylici . . .	gr. XL	2 Gm.
Alcoholis		
Glycerini . . .	āā ♏xx	āā 1 Cc.
Adipis Benzoati . . .	℥ij	50 Gm.
Ft. ung.		

Sig. 'To be rubbed into the affected parts daily.'

℞

Cocainæ	gr. vj	0·4 Gm.
Acidi Oleici	gr. xxiv	1·6 Gm.
Adipis	ʒij	8·0 Gm.
Ft. ung.		

Sig. 'To be used as directed.'

℞

Adipis Lanæ	℥ss	15 Gm.
Adipis Benzoati . . .	℥j	30 Gm.
Aquæ Rosæ	℥iss	45 Gm.
Ft. ung. Pone in tubam stanneam.		

Sig. 'To be applied frequently.'

℞

Sulphur. Præcip. . . .	℥j	30 Gm.
Saponis Mollis . . .	℥ij	60 Gm.
Adipis Benzoati . . .	℥v	150 Gm.
Ft. ung. Det. in pyxid. assula.		

Sig. 'To be rubbed into the skin every night as directed.'

℞

Balsam. Peruviani . .	ʒij	8 Gm.
Saponis Mollis		
Aquæ	āā ʒiij	āā 12 Gm.
Adipis Lanæ . . .	℥j	30 Gm.
Ft. ung.		

Sig. 'To be rubbed into the affected part every evening.'

PASTÆ

Although this term is often applied to any preparation having a certain recognised consistence, it is convenient to limit it to certain semi-solid preparations which are used externally. Some of these have a fatty, others a non-fatty, basis.

The fatty or **unguent pastes** resemble ointments in appearance, but owing to containing a large quantity of inert powder (40 per cent. or more) they are less tenacious and much stiffer. They also differ from ointments in having a slight drying action (possibly owing to capillarity), in being cooler, and in hindering absorption and penetration somewhat more than ointments of similar composition.

The following pastes are examples of this class. The first two are bases, and almost any active drug may be incorporated with them; but if any considerable percentage of powder is added it is advisable to reduce the quantity of inert powder in the vehicle. A paste should not generally contain more than 60 per cent. of powder (an oil—almond, linseed, or olive—will take up 70 per cent.).

Examples

℞

Zinci Oxidi	℥j	30 Gm.
Amyli	℥j	30 Gm.
Paraffini Mollis . . .	℥ij	60 Gm.

Fiat pasta lege artis.
(Lassar's paste.)

℞

Zinci Oxidi	ʒx	40 Gm.
Kaolini	ʒij	8 Gm.
Adip. Benzoat. . . .	℥iiiss	104 Gm.

Ft. past.
(Unna's zinc paste.)

℞

Acidi Salicylici . . .	gr. v.	0·4 Gm.
Amyli	ʒiss	6·0 Gm.
Kaolini	ʒss	2·0 Gm.
Ung. Zinci	ʒvj	25·0 Gm.

Ft. past.

℞

Sulphur. Præcip. . . .	ʒiv	14 Gm.
Zinci Oxidi	ʒvj	21 Gm.
Kaolini	ʒij	7 Gm.
Adip. Benzoat. . . .	℥iiiss	98 Gm.

Ft. past. secund. art.
(Unna's sulphurated zinc paste.)

The addition of soap to pastes is sometimes advantageous, especially if the paste lacks cohesion, but it is rarely necessary. If the action of soap also is required, soft soap may replace a portion of the fatty excipient, or may replace it entirely.

A fixed oil and an alkali form a paste with greater absorbent properties than the purely unguent pastes.

Examples

℞
Zinci Oxidi
Magnes. Carbonat.
Olei Lini
Liquoris Calcis . . āā ℥j āā 30 Gm.
Ft. past.

℞
Zinci Oxidi . . . ℥j 30 Gm.
Cretæ Præp.
Liq. Plumb. Subac. Fort.
Olei Lini . . . āā ℥ss āā 15 Gm.
Ft. past.

Wax pastes, although not strictly unguent pastes, form a connecting link with the non-fatty pastes, and are consequently best considered here. They are recommended by Schleich. His cerate paste is prepared by adding gradually, with constant stirring, 10 grammes of Liq. Ammoniæ Fortis to 100 grammes of melted beeswax, and then sufficient warm distilled water (about 180 Cc.) in small portions, and with constant stirring, until a creamy mass, which assumes a pasty consistence on cooling, is produced. If granular, the paste should be heated on a water-bath and stirred until homogeneous, a few drops of ammonia water being added if necessary. The paste is neutral, only slightly adhesive, and may be mixed with fats (vaseline, wool-fat, etc.), and aqueous solutions if not acid. Schleich's wax-gelatin or glutin-cerate is prepared in a similar way, a solution of gelatin (10 per cent.) which has been cleared with white of egg, and boiled for two hours, and afterwards made alkaline with sodium carbonate solution, being used in place of distilled water. About 10 per cent. of powder may be mixed with either paste. (For details of these and similar preparations see Schleich's 'Wundheilung').

The **non-fatty pastes** have usually a glycerin-starch, glycerin-gelatin, or albuminous basis, but

dextrin and other substances have been used. These pastes are the result of a desire on the part of dermatologists for protective or ointment-like preparations of a non-oleaginous character which would mix with water. Their action, and that of the active substances contained in them, is mainly superficial, but they are cleanlier, cooler, and, if there is much exudation from the skin, better applications than ointments. Those pastes which contain glycerin remain moist; the others gradually dry, and may form a varnish-like covering.

Glycerin starch paste.—The official glycerin pastes (Glycerinum Amyli, Glyceritum Amyli U.S.P.) contain too much glycerin for dermatological purposes. The quantity of this should not exceed that of the water present, and may often be much less (20 to 25 per cent.). Next to gelatin, starch is the best substance to form a paste with glycerin and water. The mixture should be boiled, and, after having cooled, zinc oxide or more active substances (resorcin, chrysarobin, ichthyol, iodoform, ammoniated mercury—5 to 10 per cent.) may be added. The following are Unna's and Paschkis's bases respectively :

℞
Amyli Oryzæ . 30 Gm.
Glycerini . . 20 Gm.
Aq. Destillatæ . 150 Cc.
M. terendo ; decoque ad 150 Gm.

℞
Amyli . . 27 Gm.
Sapo. Duri . 5 Gm.
Aq. Destillat. . 10 Cc.
Alum. Acetotart. 5 Gm.
Album. Ovi unius
Ft. past.

Tragacanth pastes are represented by Pick's paste—tragacanth 5, glycerin 2, water 93, mixed and heated on a

water-bath—and Unna's gelanthum, which, stated broadly, consists of a tragacanth mucilage, a gelatin solution (2 per cent.) heated until its power of gelatinising is lost, glycerin (5 per cent.), thymol (0·02 per cent.), and rose water. Both pastes dry on the skin. Pick's paste may be used as an excipient for tars, balsams, ichthyol, etc., 5 to 10 per cent. of each. Gelanthum will carry up to 40 per cent. of salicylic acid, resorcin, pyrogallol, or ichthyol. A modified formula for gelanthum by Skinner is: Tragacanth ʒiiss, gelatin ʒij, glycerin ʒvj, thymol ½ gr., distilled water to make ℥xij.

Dextrin paste possesses no obvious advantages. It is prepared by heating equal parts of dextrin, glycerin, and water on a water-bath for half-an-hour under a reflux condenser. After cooling, ichthyol (10 per cent.) or other drug is added.

Acacia pastes.—The following so-called pepton-paste of Schleich belongs to this class: Dry peptone, 15 Gm.; starch, 15 Gm.; zinc oxide, 15 Gm.; powdered gum acacia, 30 Gm.; sterilised distilled water, 30 Cc.; lysol, 10 drops; oil of citronella, 10 drops. It may be used as a basis for mercury (30 per cent.), iodoform (10 per cent.), ichthyol (10 per cent.), Liquor Iodi (10 per cent.), etc.

Glycerin-gelatin pastes (gelatinæ, gelata) are the most generally useful of preparations of this kind. They consist of glycerin, gelatin, zinc oxide, and water (and usually a medicament), the proportions of which may be varied considerably. Speaking generally, it is best to use a paste as soft as possible, but the paste should not be quite liquid at the body temperature. Some substances—*e.g.*, carbolic acid, resorcin, tars, ichthyol—diminish the gelatinising power of gelatin, and hence for these a larger proportion of gelatin is necessary. Insoluble powders—*e.g.*, sulphur, iodoform—have little effect upon the melting-point of a glycerinated gelatin mixture, although they increase its con-

sistence. The following mixtures are commonly used, and will be found sufficient for nearly all purposes:

Gelatum Zinci Durum		*Gelatum Zinci Molle*	
℞		℞	
Zinci Oxidi .	partes x	Zinci Oxidi .	partes xv
Gelatini .	partes xxx	Gelatini .	partes xv
Glycerini .	partes xxx	Glycerini .	partes xxv
Aquæ . .	partes xxx	Aquæ . .	partes XLV
Ft. gel. secund. art.		Ft. gel. secund. art.	

The harder paste is used for carbolic acid, resorcin, salicylic acid, tars, ichthyol (5 to 10 per cent.), and other substances which affect the gelatinising power of gelatin. The softer paste is employed for insoluble or slightly soluble powders—chrysophanic acid, sulphur, iodoform, ammoniated mercury, etc. Substances which precipitate gelatin solutions (tannic acid, mercuric chloride, etc.) should not be prescribed in this form.

As these pastes are solid jellies at ordinary temperatures, they require liquefying on a water-bath before being applied. They are then painted over the affected part, and after congealing somewhat are covered with a thin layer of cotton-wool or a bandage.

Proteid bases.—The best known is the Unguentum Caseini introduced by Unna. It consists of casein 14, caustic potash 3·45, caustic soda 0·85, glycerin 7, soft paraffin 21, phenol 0·5, zinc oxide 0·5, water to make 100.

It is prepared by dissolving the dry casein in the caustic alkali in dilute solution, adding the glycerin and the carbolic acid, then the soft paraffin and zinc oxide, and emulsifying by shaking. Any fat can be used in place of the

soft paraffin; and the emulsifying fluid can be simply prepared by dissolving plasmon in a mixture of ammonia water and glycerin and evaporating off the free ammonia. The casein ointment is a thick, milky liquid which is miscible with most substances except acids, and will emulsify considerable quantities of tar and similar compounds. When laid on the skin it forms a flexible film almost free from greasiness.

Schleich's serum paste cannot be conveniently prepared on a small scale, and therefore needs no description here.

Emplastra—Chartæ

Plasters are external applications consisting of an adhesive mixture thinly spread upon a support. Officially, the term is applied to the plaster substance itself; and the official plasters are solid at ordinary temperatures and only become soft and adhesive at the temperature of the body. They are being to a large extent replaced by plasters with a rubber basis, which are manufactured on a commercial scale.

Plasters may be employed for a mechanical action (protection, traction, or merely support) or for a medicinal action (local or general). For a purely mechanical action the plaster should be spread upon a sufficiently rigid support and should have no deleterious action on the skin. It is an advantage if, like the plasters with a rubber basis, it will adhere to a slightly moist surface and it can be applied without the aid of heat. To produce a medicinal effect it is necessary that the active substance should penetrate into the skin; and for this to occur it must be capable of entering into solution in the cutaneous secretions (see page 20).

The plaster bases themselves penetrate very slowly or not at all, and as they are colloidal masses of stiff consistence they impede the transference of substances contained in them to the skin. Hence the plaster form is the most slowly acting of any medicinal form; and the concentration of drug in it may be greater than that of most other local applications. As the action of a drug is limited almost solely to the surface of the plaster, plasters should be spread as thinly as possible.

The medicinal use of plasters should be limited to a local action. Absorption from them through the skin, even when it occurs, is too inconstant to make them useful means for producing a general action. Mercurial plaster is perhaps an exception: the absorption from it may sometimes be utilised with advantage. Belladonna plaster occasionally produces symptoms of belladonna poisoning owing to absorption of the alkaloids. This is more liable to occur if the part has been excoriated by scratching previous to the application of the plaster.

It is important to remember that aseptic precautions may be necessary in applying plasters.

The **adhesive basis** in plasters is usually lead soap, rèsin, rubber, or a mixture of these. Gelatin (isinglass) is used for preparing so-called court and skin plasters, but these are rarely medicated.

Lead plaster (Emplastrum Plumbi), or lead soap, requires a relatively high temperature to soften it, and it is consequently not sufficiently adhesive for many purposes. After prolonged application it penetrates slightly into the skin, but it exerts little

action upon it. On this account it is a useful plaster basis for substances which are required to act on the skin, and especially for those which tend to diminish its consistence.

Resin plasters.—Pure resins are too brittle and require too great heat for their fusion to permit of their being used alone as plaster bases. When combined with wax and fat or oil, however, they form a good base and one which adheres well to the skin. Some gum-resins and oleo-resins may be used alone as plaster bases, but they adhere rather firmly, and are better if combined with a little oil, wax, or other substance to increase their plasticity. A little resin increases the adhesiveness of other plasters—*e.g.*, lead plaster.

Resin plasters penetrate into the skin to a slight extent, and may cause irritation according to the kind of resin and the length of time the plaster is applied. Common resin has relatively little irritant action, but a few resinous substances are markedly irritant. Oleo-resins are irritant mainly in proportion to the volatile oil they contain. A resinous base is especially useful for irritant drugs; but alone it is unsuitable for most other drugs, although its irritant action tends to accelerate the penetration and absorption of these.

Rubber plasters.—These are largely employed at the present day, but almost all are made on a commercial scale. The various manufacturers prepare a large variety, and it can rarely happen that a plaster will not be found to suffice for any need. The plaster often consists of Para rubber, olibanum, wax, pitch, and medicinal ingredients, and is pre-

pared usually by mechanical means. A similar but less adhesive plaster can be prepared by solution. Various formulæ have been published, and of these the following may be taken as types: (i.) best rubber 4, resin (olibanum, dammar resin, etc.) 8, Japan wax 6; (ii.) best rubber 10, wool-fat 25, resin 50, dammar resin 10. The rubber is dissolved in a suitable solvent (benzene, etc.), the other ingredients added, and the mixture spread thinly upon a support.

Rubber plasters are adhesive at ordinary temperatures, and are consequently covered over with gauze or similar material after spreading, to prevent their sticking. This gauze is removed before the plaster is applied. It has been stated that a rubber basis diminishes the medicinal action of a remedy, but this is so only to a slight degree.

To the plaster base almost any drug may be added, but very few, excepting antiseptic and irritant substances, are of value when applied in this form. As regards the quantity of drug, about 10 per cent. of a volatile oil or 20 per cent. of a powder may be added to the official plasters without serious inconvenience. The amount of other substances usually falls between these limits. By employing special bases, however, a much larger quantity of a given drug can be incorporated: some of the commercial plasters contain 40 per cent. of powder. In ordering preparations with plaster vehicles it is well to remember that oily and spirituous preparations are generally better and more easily miscible than other forms; spirituous extracts, for example, are better than aqueous extracts.

Plasters may be ordered to be spread upon plaster leather (split sheepskin), chamois leather, cotton cloth, swansdown, or even different kinds of paper. The size of the plaster is indicated by stating the length and breadth, or, if circular, the diameter, in inches or centimeters; and the shape, if necessary, by stating the part to which it is to be applied. Thus for the chest the plaster is usually made heart shaped; for the loins, oblong with rounded corners; for the side, oblong with slightly concave upper and convex lower borders; for the breast, round with the centre cut away for the nipple and divided from centre to periphery so that by overlapping it may be adapted to the breast.

In prescribing plasters, 15 to 20 grains to the square inch, or 0·16 to 0·2 gramme to the square centimeter, should be allowed. There is some difficulty in spreading a plaster thinly and evenly, but the above quantity should provide a useful if not an elegant example. The thickness of the plaster substance should not exceed $\frac{1}{25}$ inch, or 1 mm.

Plaster-mulls are proprietary preparations. They were introduced by Unna, and consist essentially of a rubber plaster spread upon an impermeable (rubber) support. In action they differ little from rubber plasters having the same active ingredients.

The Emplastrum Capsici of the United States Pharmacopœia consists of the oleo-resin (0·25 gramme) spread in a thin layer, by means of a brush, on 15 sq. cm. of adhesive plaster, a margin of adhesive plaster being left around the sides.

Examples

℞

Acidi Salicylici	. . .	gr. x	0·65 Gm.
Olei Olivæ	. . . .	ʒss	2·0 Gm.
Empl. Resinæ	. . . .	gr. CLX	10·0 Gm.

Ft. empl. Extend. sup. linteum 4″ × 4″ (10 × 10 cm.).

℞

Empl. Hydrargyri
Empl. Saponis . . āā ʒij āā 8 Gm.

Ft. empl. Extende supra chartam 6″ × 4″ (15 × 10 cm.).

M.•

Empl. Picis . . . 3″ × 2″ 8 × 5 cm.

Sup. chart. extend.

Sig. 'To be applied as directed.'

M.

Empl. Belladonnæ pro mamma supra alutam extend.

Blisters.—This term is usually applied to a cantharides or similar paste (Emplastrum Cantharidis, Emplastrum Mylabridis) spread upon adhesive plaster. The so-called cantharides plaster is soft at ordinary temperatures, and is not distinctly adhesive, hence the necessity of spreading it upon an adhesive support. It should be spread thinly—but thickly enough to obliterate the underlying plaster—and evenly, and a border of adhesive plaster should be left to fix it in position. The size is usually 1 inch square (2·5 sq. cm.), very rarely more than 2 inches square. For behind the ears a special shape, which is roughly indicated by the space formed when the tip of the fore-

finger comfortably touches the tip of the thumb, is employed.

Examples

M.

Emplastrum Cantharidis . $1\frac{1}{2}'' \times 1\frac{1}{2}''$ (4 cm. × 4 cm.)

Sig. 'To be placed over the centre of the painful area and left for six hours; subsequently the part to be fomented until a good blister forms.'

M.

Emplastrum Cantharidis pro aure dextra applic.

Sig. 'To be placed over the mastoid and left for ten hours, the blister being subsequently dressed with boric acid ointment.'

Chartæ.—These consist of an active ingredient mixed with solution of indiarubber and spread upon cartridge paper. Only one—the official Charta Sinapis—is in use; and it is more frequently prescribed by word of mouth to the patient or his friends than ordered by prescription from the pharmacist. Other substances than mustard might be prescribed in this form, but it is generally better to order a proper plaster base.

Sapones

Soaps are metallic salts of the higher fatty or of resin acids. With the exception of the soaps of the alkali metals they are insoluble in water but soluble in alcohol; sodium and potassium soaps are soluble in water and in alcohol. The latter alone possess the properties usually attributed to soap, and are the only ones (except lead plaster and other metallic oleates) employed in therapeutics.

These soaps when dissolved in water form a colloidal solution and undergo slight dissociation, producing by hydrolysis a small concentration of hydroxyl ions. To these ions the alkalinity and most of the pharmacological action of soaps are due. The dissociation and hydrolysis vary somewhat with different soaps, but for practical purposes the solubility of the soap is a sufficient indication of its strength of action. The higher the molecular weight and more complete the saturation of the fatty acid, the less soluble is its soap ; sodium stearate is less soluble than sodium margarate, and sodium margarate than sodium palmitate. The commercial soaps are mixtures of two or more pure soaps, the predominating soap giving its character to the whole. Thus curd soap is chiefly sodium stearate, hard soap mainly sodium oleate. The latter is consequently more soluble and more active pharmacologically than the former.

The chief differences in soaps, however, occur between sodium and potassium soaps. The former are hard, the latter soft. This is due in part to the potassium soaps being less pure. They cannot be salted out like the sodium soaps, and hence they contain the glycerin which is formed in their manufacture. They also usually contain free alkali, and as they are more soluble than sodium soaps, they tend to be more irritating.

In virtue of the hydroxyl ions they form in contact with water soaps are cleansing and to some extent irritant when applied to the skin, and owing to their miscibility with fatty matter they penetrate fairly readily into the epidermis. They produce,

however, some dryness and consequent roughness of the skin; an effect which has been attributed to their affinity for the fatty matter of the epidermis, but which in the case of commercial soaps is largely due to the presence of free alkali and other impurities. In order, however, to overcome this action and retain the elasticity of the skin, so-called superfatted soaps have been introduced. These consist of a purified soap containing a certain percentage of free fat, and for therapeutic purposes they are a decided improvement on the ordinary kinds of soap.

The advantages that have been claimed for soap as a dermatological basis are that it is stable and that it penetrates better into the epidermis than oily or fatty substances. A neutral sodium soap is also said to be indifferent to the skin, whereas oils and fats when rubbed into the skin are said to decompose (become rancid) and irritate. It is questionable, however, if these advantages exist; if, indeed, a pure sodium soap is as unirritating, more stable, or as penetrating as wool-fat. Soaps are, notwithstanding, more miscible with exudations, cooler, and cleanlier than oily or fatty bases, and are often better adapted for the treatment of sub-acute and chronic skin diseases.

Four grades of action of a medicated soap may be distinguished: (i.) the part is washed with the soap, cleansed with water, and dried; (ii.) the part is washed and then merely dried without cleansing; (iii.) the lather is allowed to dry on the part; (iv.) the soap with little water is rubbed well into the skin.

In prescribing soaps it is advisable to employ an official soap or a known commercial soap as a basis. The making of soap from fats or oils on a small scale is a tedious process, and the result is not likely to be satisfactory from an æsthetic point of view. There is, however, little difficulty in incorporating drugs with a prepared soap, or in mixing two soaps and remoulding; but often the prescriber will find that his wants have been anticipated, and that a soap sufficient for his needs has been put upon the market.

The following superfatted medicated soaps, all of which contain 5 per cent. of drug unless otherwise indicated, are prepared by a well-known firm: Ammoniated mercury, arsenious acid, balsam of Peru, benzoin, birch tar, borax, boric acid, camphor, chrysarobin, coal tar, formaldehyde, lysol, menthol, naphthol, phenol, potassium iodide, resorcin, salicylic acid, salol, storax, thiol, thymol; ichthyol (10 and 15 per cent.), sulphur (10 per cent.), zinc oxide (10 per cent.), zinc tannate (3 per cent.), pyrogallol (1 and 3 per cent.), mercuric chloride (1 per cent.), picric acid (1 per cent.), cantharidin (0·1 per cent.), and various combinations of these substances.

When prescribing soaps to be prepared, the incompatibility of soluble metallic salts other than those of the alkali metals should be remembered (page 105). It is generally better in such cases to employ the metallic oleates, although the addition of oleic acid, wool-fat, or glycerin will avoid the incompatibility or diminish it to a considerable extent.

So-called soap solutions, whether aqueous or spirituous, medicated or not, are essentially liniments or paints.

Balnea

Medicated baths for home use rarely require a prescription. Generally some substance in domestic use (*e.g.*, soft soap, soda, salt, mustard) is employed, but if poisonous substances (*e.g.*, mercuric chloride, iodine) or immiscible liquids (*e.g.*, turpentine) are required a prescription is necessary. This need not differ, except in quantity, from that of other forms of medicines.

Medicinal baths may be limited to one or other part of the body (local baths—*e.g.*, foot-baths, arm-baths, etc.), or may extend over the whole body except the head (full baths). The size of baths varies enormously, and as the action of a drug in a bath depends upon its concentration, it is necessary to know approximately the size of the bath to be used before prescribing, unless the better but more tedious method of measuring the water is resorted to. The bulk of a full bath for an adult varies from 25 to 65 gallons (125 to 300 liters); for a child, from 5 to 25 gallons (24 to 125 liters). A sitz-bath is about 5 gallons (24 liters), a foot-bath about 3 gallons (14 liters).

The following baths are those most commonly used in ordinary practice. The quantities given are those for a full bath of about 45 gallons (200 liters). For local baths the proportion may sometimes be increased with advantage.

Alkaline.—7 to 14 oz. (200 to 400 Gm.) common soda or potashes, or 1½ oz. (40 Cc.) liquor potassæ, or ½ to 2 lb. (200 to 800 Gm.) soft soap.

Saline.—2 to 9 lb. (1 to 4 Kg.) common salt or other (*e.g.*, Stassfurt) salt. Brine baths are stronger; they may be up to 6 per cent.

Mustard.—8 to 12 oz. (250 to 350 Gm.) common mustard. [A foot bath is relatively stronger, 3 to 4 oz. (100 Gm.).]

Sulphide (often called Sulphur).—2 to 5 oz. (50 to 150 Gm.) of sulphurated potash. A wooden bath-tub is necessary.

Mercuric chloride.—60 to 120 grains (4 to 8 Gm.), which should be dissolved in water or alcohol before adding to the bath. A wooden bath is best; a zinc bath should be avoided.

Turpentine.—2 to 3 oz. (60 to 100 Cc.) made into an emulsion with soft soap.

Starch, etc.—1 lb. (500 Gm.) starch; or 2 lb. (1 Kg.) bran; or 2 lb. (1 Kg.) gelatin; all of which should be dissolved as far as possible by mixing with sufficient water and heating before adding to the bath.

Carbonic acid.—Best prepared by means of Sandow's or similar tablets; or $\frac{1}{2}$ to 1 lb. (250 to 450 Gm.) sodium bicarbonate may be dissolved in the bath water, and the same quantity of commercial hydrochloric acid added; or the acid may be added first and the sodium bicarbonate thrown in in divided portions.

Medicated vapour baths.—Of these the calomel bath alone need be mentioned. In its simplest form the patient is seated on a cane-bottomed chair and covered with a macintosh sheet or other impervious cover; 20 grains of calomel is placed on an iron plate which can be heated by a spirit lamp, and this is placed in a bowl or other receptacle

under the chair. The calomel is volatilised, and part settles on the skin. The method is useful in the treatment of extensive syphilitic sores, and is less troublesome than but inferior to a mercurial bath.

Inhalationes—Nebulæ—Fumigationes

Inhalations are gases (vapours) or clouds which are taken into the lungs or upper air passages by the act of inspiration. Gases (oxygen, nitrous oxide, etc.) are not ordered in the form of a prescription. Other inhalations are prescribed as the pure drug or as a solution or mixture containing it, with directions as to the method of using it. This latter depends largely upon the physical characters of the drug and the effect it is desired to obtain. A non-volatile liquid can only be inhaled by being broken up into very fine particles (a cloud or nebula) by means of an atomiser or spray. The vapour of a slightly volatile liquid may be inhaled pure by means of a respirator, or with aqueous vapour by adding it, or a solution of it, to hot water contained in a suitable vessel. The vapour of very volatile liquids is administered by means of a handkerchief, mask, or other piece of apparatus. The only example of the last-named class that need be referred to is amyl nitrite, which for therapeutic purposes is prescribed in small glass capsules (page 201), containing an appropriate dose (5 minims). Many other drugs could be dispensed in a similar way if necessary, but most others of this class (chloroform, ether, ethyl chloride) are usually administered by the physician or surgeon when required.

The drugs most commonly prescribed as inhalations are moderately or slightly volatile liquids. These may generally be prescribed pure if it is intended to administer them by means of a respirator; but if volatilisation by hot water is desired, an alcoholic or other solution is to be preferred. This ensures distribution of the medicament, which is often but slightly soluble in water, over the surface and in the superficial layers of the water, and aids its dispersion as vapour. A powder or an emulsion form may be used to produce the same result. This method of inhaling from hot water is the most generally useful, but is also the most troublesome. The respirator method is best adapted for antiseptic and deodorant drugs.

Most of the drugs administered as inhalations are intended to have a local action on the mucous membrane or excretions of the respiratory tract, and this action depends largely upon the concentration of the vapour of the drug in the inspired air. This in turn depends upon the volatility of the drug and certain other physical conditions, and it is important to remember this, as it bears directly upon the quantity which may be prescribed for an inhalation, and the length of time the inhalation may be continued. As examples of substances used for inhalation with aqueous vapour (*cf.* page 51) may be mentioned—creosote (20 minims), liquefied carbolic acid (20 minims), terebene or oil of pine (5 to 10 minims), compound tincture of benzoin (60 minims), dilute hydrocyanic acid (2 to 4 minims). These are added to ½ or 1 pint of warm water.

Examples

M.

Tinct. Benzoin. Co. . .	℥ij	50 Cc.

Sig. 'One small teaspoonful to be added to warm water, and inhaled three times a day as directed.'

℞

Creosoti	ʒij	8 Cc.
Olei Eucalypti . . .	ʒss	2 Cc.
Alcohol. Absol. . . .	℥ss	15 Cc.
Ft. sol.		

Sig. 'One teaspoonful to be added to warm water and inhaled as directed.'

℞

Olei Gaultheriæ . .	ʒiss	6·0 Cc.
Olei Cinnamomi . . .	ʒss	2·0 Cc.
Olei Menth. Pip. . .	♏x	0·6 Cc.
Alcohol. Absolut. .	ad ℥ss	ad 15·0 Cc.
Ft. inhal.		

Sig. 'Ten drops to be placed in the inhaler and used as directed.'

℞

Spir. Ætheris		
Spir. Chloroformi .	āā ʒss	āā 15 Cc.
Ft. mist. Det. in lag. obtur.		

Sig. 'The Inhalation. To be used as directed.'

Nebulæ, or sprays, are employed when the drug is not sufficiently volatile to enable it to be administered by volatilisation, occasionally as a matter of convenience. The drug should be in solution. The more limpid the solution the more easily it is atomised, but comparatively viscous solutions may be employed in some forms of apparatus. A high

boiling paraffin, sold under various names, is frequently used as a solvent, but its solvent action is largely limited to organic substances (camphor, menthol, volatile oils, phenol, etc., see page 68), and it is immiscible with water. (For the action of such a solvent see page 21.) Water, and glycerin and water are also used.

Examples

℞

Camphoræ		ʒij	8 Gm.
Menthol.		ʒj	4 Gm.
Paraffini Liq. . . .		℥ij	60 Cc.
Ft. sol.			

Sig. 'To be sprayed twice a day as directed.'

℞

Acid. Carbolici . . .		ʒij	8 Gm.
Glycerini		℥j	30 Cc.
Aquam Rosæ . .	ad	℥iv	ad 120 Cc.
Ft. sol.			

Sig. 'One dessertspoonful to be sprayed every morning.'

Fumigating pastilles or tapers are comparatively rarely prescribed, and still more rarely is a prescribed formula given for them. They consist mainly of potassium nitrate and charcoal, and usually a vegetable powder, with a small portion of volatile oil as a perfuming agent. Camphor, menthol, carbolic acid, benzoic acid, balsams, and similar substances may be employed as active ingredients. The fumes inhaled by the patient consist of the vapour of any volatile substances present and the vapours produced by the deflagration of the oxidising substance and organic matter. The

latter vapours are mainly those of pyridin, hence this substance is used by some asthmatics instead of fumigating preparations. About ten drops is placed on a plate near the bed (or twenty to thirty drops on a plate under the bed) and allowed to evaporate.

Medicated cigars and cigarettes from a prescriber's point of view need no consideration.

DISPENSING

The only royal road to efficient prescribing is through the portals of dispensing. It is only by gaining some practical acquaintance with the forms in which drugs may be administered that the best means of administering them becomes apparent. In the following exercises the student is given examples of the forms in common use, with hints regarding the mode of dispensing them. The various manipulations necessary in dispensing (weighing, measuring, infusing, etc.) are not described, because these can be more easily and more efficiently learned by demonstration than by written description. The student should cultivate the habits of neatness and accuracy, and should endeavour to dispense and finish a prescription in the manner expected of a good pharmacist.

Misturæ

A mixture may consist of a solution or a suspension of a drug or drugs in water, or of substances partly in suspension and partly in aqueous solution. Most prescriptions for mixtures consist of solutions of solids or liquids soluble in water, and little difficulty is experienced in dispensing them. In the case of miscible liquids the ingredients may usually be added in any order with the same result;

and this is generally true of soluble solids, provided that solution of the solid or solids is first obtained. Occasionally, however, the order of mixing is of importance. Two ingredients contained in a prescription may produce a precipitate or other chemical change when mixed in a certain concentration, and not when further diluted; or a third substance may be present which, when added to one or other ingredient, may prevent precipitation, and so on. In dispensing, *chemical interaction, unless intended, should as far as possible be avoided.* Every endeavour should be made to obtain the proper proportion of the drugs in the prescribed dose of medicine. Small quantities of limpid liquids must be measured in a small measure, and if very volatile should be added last, just before corking the bottle, to avoid loss by evaporation; viscous liquids are generally measured in a wider measure, which can be easily cleansed. The residuum in all measures and utensils employed should be washed out with the menstruum prescribed and added to the contents of the medicine-bottle.

For teaching purposes the contents of mixtures may be divided into the following groups:

Liquids miscible with water.—As most of the official preparations of drugs in common use are miscible with water[1] the majority of prescriptions belong to this class. Such prescriptions may usually be dispensed in any order. In such cases it is

[1] Many preparations (tinctures especially) produce some turbidity when added to water. This may be due to inert resinous matter, to the presence of volatile oils, etc., but if these remain in suspension and the chief ingredients remain in solution such may be considered as miscible preparations.

generally best to pour some of the excipient into the bottle and add the remainder of the ingredients in the order in which they are written. Only one example need be given [1]:

MR. JOHN SMITH.

Recipe

Tincturæ Digitalis	.	drachmas duas	8 Cc.
Spiritus Chloroformi	.	drachmam	4 Cc.
Aquam [2] . .	ad	uncias sex [3]	ad 200 Cc.[3]

Fiat mistura. Capiat cochleare magnum tertia quaque hora.

14 March, 07. C. R. MARSHALL.

Soluble solids.—If the prescription contains a soluble solid this should first be dissolved in the excipient. If the solid is quickly soluble and occurs in small crystals or powder, solution may be effected in the bottle; but if it is slowly soluble or occurs in lumps or large crystals, solution is more quickly obtained by trituration with some of the excipient in the mortar. Complete solution, if this is intended by the prescriber, should be obtained before the bottle is wrapped up.

Recipe

Sodii Salicylatis .	.	grana viginti	1·25 Gm.
Tincturæ Aurantii	.	minima viginti	1·25 Cc.
Aquam . .	ad	semunciam	15·0 Cc.

Fiat mistura. Mitte uncias sex (200 Cc.).

Signetur, Semuncia tertia quaque hora sumenda.

---

[1] Students are recommended to taste the medicines they dispense and try to distinguish the individual ingredients.

[2] Aqua in prescriptions means distilled water.

[3] The sizes of bottles are given on page 8 (footnote).

As the inscription is only for one dose the amount of the first two ingredients must be calculated. Weigh the calculated quantity of sodium salicylate and put it into the bottle; fill the bottle half full with the excipient (water), and agitate gently until the salt is dissolved. Measure out and add the tincture of orange (note the opalescence produced by precipitation of volatile oil), fill the bottle with water, cork, and finish.

℞

Chloral Hydratis				
Potassii Bromidi .	āā	gr. x	āā	0·65 Gm.
Syrupi		℥ss		15·0 Cc.
Aquam . . .	ad	℥j	ad	30·0 Cc.

Fiat haustus.

Sig. Hora somni sumendus.

Weigh out the two solids and dissolve in nearly half an ounce of water previously poured into the bottle; add the syrup, and fill up, if necessary, with water.

In the case of a few solids special precautions are necessary to obtain a proper solution. Scale preparations of iron, although very soluble in water, will, if placed in a bottle and water poured on, often cake at the bottom, thereby considerably prolonging solution—not infrequently in medicines containing these compounds undissolved drug may be seen at the bottom many hours after the dispensing has been completed. Such substances should be scattered on the surface of a portion of the excipient in a measure and stirred until solution is effected.

Efflorescent substances should have the effloresced part scraped away before being weighed for

dispensing. The following prescription contains an example :

℞

Ammonii Carbonatis .	.	gr. xl	2·5 Gm.
Tincturæ Scillæ .	. .	ʒiss	5·0 Cc.
Syrupi Tolutani .	. .	℥j	25·0 Cc.
Infusum Senegæ	. ad	℥vj	ad 150·0 Cc.

Ft. mist.

Cap. ℥ss t. i. d.

Make the infusion. Take a piece of ammonium carbonate and scrape away any white coating that may be present until a translucent lump is obtained. (The white effloresced coat is ammonium bicarbonate. This is much less active therapeutically than ammonium carbamate, which is present along with the bicarbonate in the official ammonium carbonate.) Powder this lump in a mortar and dissolve it in about two ounces of the infusion of senega. Pour into the bottle, and wash out the mortar with more of the infusion. Add the tincture of squill and syrup of tolu and sufficient infusion to fill the bottle. During the dispensing shaking of the contents of the bottle should be avoided as far as possible, owing to the frothing produced by the saponins of the senega.

If a soluble solid is prescribed with insufficient menstruum for its solution, it should be rubbed in the mortar to a state of fine powder, mixed with a small quantity of the excipient to form a paste, and afterwards diluted and poured into the bottle, sufficient menstruum being added to make the desired quantity. Heat should not be employed to obtain complete solution, since the excess above

that required for saturation will crystallise out (*c.f.* page 119).

Insoluble compounds.—The compound may be an insoluble solid or an immiscible liquid. The latter, along with resins (which are solids immiscible with water), is separately dealt with under Emulsions (page 260). But in all cases the main point in dispensing is to get the insoluble ingredient into as fine division as possible and into such a state that it will be uniformly suspended throughout the mixture by gentle shaking. If the nature of the ingredient require it, the prescriber will probably have included something to aid its admixture, or its suspension for a sufficient length of time to permit of the administration of the mixture.

Insoluble solids (except resins) are rubbed, if necessary, to a state of fine powder in a mortar and triturated to a paste with a small quantity of the excipient. The remainder of the excipient and the other ingredients are then gradually added. If a suspending agent is included in the prescription, this, if in solid form, is generally mixed with the other solid ingredients before the addition of any excipient; if a liquid, it is commonly added after the insoluble solid has been rubbed to a paste.

℞

Pulv. Rhei Co. . . .	ʒiss	6 Gm.
Aquæ	℥ij	60 Cc.
Ft. mist.		

Sig. ʒj t. d. s.

This is a light powder, and requires no suspending agent. Weigh out the powder, place it in a

mortar, and triturate with sufficient water (about 1½ drachm or 6 Cc.) to form a thick paste. Gradually add more water, triturating after each addition. Pour into the bottle, and use the remainder of the excipient to wash out the mortar.

A few light substances which are naturally somewhat adhesive in nature—*e.g.*, camphor—cannot be powdered sufficiently finely by trituration alone. In such cases the addition of a small quantity of a volatile solvent for the substance (alcohol for camphor) and subsequent trituration will generally produce a sufficiently fine powder. These substances, however, generally require a suspending agent for their efficient dispensing.

℞

Bismuthi Carbonatis .	. ʒiij	12 Gm.
Sodii Bicarbonatis .	. ʒij	8 Gm.
Acidi Hydrocyanici Dil.	. ʒj	4 Cc.
Mucilaginis Acaciæ .	. ʒvj	25 Cc.
Aquam Cinnamomi .	ad ℥vj	ad 200 Cc.

Ft. mist.

Sig. ℥ss t. d. s. a. c.

Mix the bismuth carbonate and sodium bicarbonate in a mortar. Add sufficient cinnamon water to form a thin paste; then add the mucilage and mix intimately. Dilute with more cinnamon water until thin enough to pour easily into the bottle. Use the remainder of the cinnamon water in portions to wash out the mortar, shaking the bottle after each addition. Lastly add the dilute hydrocyanic acid.

℞

Bismuthi Subnitratis .	. ℥ss	16 Gm.
Glycerini	. ℥iss	50 Cc.
Aq. Menthæ Piperitæ .	ad ℥iij	ad 100 Cc.

Ft. mist.

Cap. coch. med. ante sing. cib. ex aq.

Rub the bismuth subnitrate to a paste with about two drachms (8 Cc.) of peppermint water. Add the glycerin, mix by trituration, and pour into the bottle. Wash out the residuum in the mortar with the remainder of the peppermint water into the bottle.

Bismuth subnitrate is a very heavy powder, and if merely mixed with water it quickly settles to the bottom of the bottle after shaking. It is incompatible with mucilages (page 92), hence these should not be used to suspend it.

As bismuth subnitrate gradually decomposes in contact with water, liberating nitric acid, it should not be prescribed with sodium bicarbonate or other soluble carbonate. In a few cases where this has been done sufficient carbonic acid has been formed to burst the bottle.

The chalk mixture of the British Pharmacopœia affords an example of a powder suspended with tragacanth.

℞

Cretæ Præparatæ . .	gr. cx.	5·0 Gm.	1
Tragacanthæ . . .	gr. xv.	0·7 Gm.	·14
Sacchari Purificati . .	gr. ccxx	10·0 Gm.	2.
Aquam Cinnamomi .	ad ℥viij	ad 160·0 Cc.	32 6cc
Ft. mist.			

Cap. ℥ss t. i. d. inter cib. donec diarrh. cessaverit.

Triturate the chalk, tragacanth, and sugar until intimately mixed. Add about two ounces (60 Cc.) of cinnamon water, and form a smooth paste. Add the remainder of the cinnamon water in portions.

Emulsiones

When a liquid (or solid) immiscible with water is prescribed in the form of a mixture, an emulsifying agent (see page 129) will be found in the prescription. The emulsifying agents most commonly used are gum acacia, tragacanth, and yolk of egg. Alkalies and preparations containing saponins (tinctures of quillaia and of senega) are occasionally employed; but these and soap are better limited to medicines for external use. The effect of the first three will be best ascertained by employing the same formula and simply varying the emulsifying agent.

Gum acacia.—Either the mucilage or finely-powdered gum may be employed. The dry-gum method generally gives the best results in the hands of students.

Method I.

℞

Olei Morrhuæ . . .	℥ij	50 Cc.
Mucilaginis Acaciæ . .	ʒvj	18 Cc.
Syrupi	℥ss	12 Cc.
Aquam Cinnamomi .	ad ℥iv	ad 100 Cc.

Ft. mist.

Sig. ℥ss t. d. s. p. c.

Test the mucilage with litmus paper. If more than slightly acid it should be rejected. Put the mucilage into a relatively large mortar; add one to two drachms of cod-liver oil, and rapidly but gently triturate until no oil globules are visible. This complete emulsification of the first portion is essential to success. Then add another similar portion of cod-liver oil, and again triturate until

emulsification is complete. Repeat the process with the remainder of the oil, adding it in portions, until the whole is incorporated. To this add a small quantity of cinnamon water (two or three drachms), and incorporate by trituration; then add the syrup, mix, and pour into the bottle. Use the remainder of the cinnamon water to cleanse out the mortar into the bottle.

Hard trituration in preparing emulsions must be avoided: the friction produces heat, and this is inimical to emulsification. A light rapid movement in one direction is best.

The oil globules are broken up into smaller and smaller globules because the trituration elongates the globule to a cylinder, which divides as soon as its length is greater than twice its diameter. This subdivision continues until the globules become so small that they cannot be sufficiently elongated by trituration.

Method II.

℞

Olei Morrhuæ	℥ij	50 Cc.
Acaciæ Gummi . . .	ʒiv	12 Gm.
Syrupi	℥ss	12 Cc.
Aquam Cinnamomi .	ad ℥iv	ad 100 Cc.
Ft. emulsio.		

Sig. ℥ss t. d. s. p. c.

Weigh out finely-powdered gum acacia; put it into a *dry* mortar; add the whole of the cod-liver oil, and mix intimately; then add *all at once* six drachms of cinnamon water (one and a half times the quantity of gum used), and triturate until the primary emulsion is formed; then proceed as in Method I.

The process of emulsification in this case is somewhat different from the first method. In the first stage the

particles of gum are uniformly diffused through the oil, but when the proper quantity of water is added and trituration performed, the particles of gum are dissolved by the water and fine drops of mucilage are formed. These coalesce, and in so doing break up the oil into fine globules which are enveloped by the mucilage. The addition of water and the trituration have, so to speak, reversed the previous condition.

The dry-gum method may also be used to prepare emulsions in the bottle, but the result is not so satisfactory. An example is supplied in the Emulsum Olei Terebinthinæ U.S.P.:

℞

Olei Terebinthinæ Rectificati	ʒv	15 Cc.
Olei Amygdalæ Expressi .	♏c.	5 Cc.
Syrupi	℥j	25 Cc.
Pulveris Acaciæ Gummi .	gr. ccc.	15 Gm.
Aquam . . .	ad ℥iv	ad 100 Cc.

Ft. emuls.

Cap. ʒss 3[tia] qq. hora.

Put the gum acacia into a dry bottle; add the oil of turpentine and expressed oil of almond, and mix thoroughly; add one ounce (30 Cc.) of water, and shake vigorously until emulsification is complete; add the syrup, then the water, each in divided portions, shaking after each addition.

Yolk of egg.

℞

Olei Morrhuæ	℥ij	50 Cc.
Vitellos Ovorum . . .	ij	2
Syrupi	℥ss	12 Cc.
Aq. Cinnamomi . .	ad ℥vj	ad 150 Cc.

Ft. emuls.

Sig. ℥ss t. d. s. p. c.

Separate the yolks of two eggs and place them in a mortar; rub to a uniform consistence; add the oil in small portions, emulsifying each addition. After more than half of the oil has been emulsified, cinnamon water in small portions may be added alternately with the oil; but generally it is better to incorporate the whole of the oil first. The cinnamon water is then added in small portions, each of which is incorporated. Finally, the syrup is added and the mixture strained into the bottle.

The emulsion may be made with mucilage of tragacanth (℥j) as an emulsifying agent, but the mixture obtained is decidedly inferior to those produced with gum acacia or yolk of egg.

Small portions of the various emulsions should be placed in test-tubes, and diluted with one, two, and three times the quantity of water. By observing these after standing two and twenty-four hours, the student will gain an idea of the proportion of emulsifying agent necessary to ensure a certain degree of permanency in an emulsion. The effect of adding alcohol, acids, alkalies, and salts to the several emulsions should also be noted.

Tragacanth.—The use of tragacanth as an emulsifying agent is limited. It is a good suspending agent, but a bad emulsifying agent; the emulsions made with it are coarse and have an opalescent rather than a milky appearance. But, notwithstanding the relatively large size of the globules of emulsified substance, separation does not readily

occur, owing to the strong suspending power of tragacanth mucilages.

A good idea of the best method of using tragacanth as an emulsifying agent is gained by preparing the B.P. mucilage. In making this (tragacanth 6 grains, alcohol 12 minims, water to make 1 fl. oz.), the powdered tragacanth is placed in a perfectly dry bottle, the alcohol is poured on and, by gentle agitation of the bottle, is made to damp thoroughly the particles of tragacanth. The whole of the water is then added, and the bottle quickly and violently shaken. A uniform thick mixture should result. If water alone is added to tragacanth powder, and the mixture shaken, the tragacanth particles unite and form lumps, but no true mucilage is produced. This is owing to the tragacanth consisting mainly of a gum which is only slightly and partially soluble.

In using tragacanth for dispensing it is necessary to employ very fine powder, and to wet the particles with a liquid having no solvent action on them previous to adding water. The best liquids are those which are miscible with water (alcohol, acetone, etc.); but almost any organic liquid will suffice. As a tragacanth emulsion can be prepared in a bottle, tragacanth is generally used for emulsifying volatile organic liquids, especially those with an irritating or unpleasant taste, which the viscosity of the mixture helps to cover.

℞

Olei Terebinthinæ .	.	℥ss	12·5 Cc.
Pulv. Tragacanthæ .	.	gr. xxiv	1·6 Gm.
Syrupi Aurantii	.	℥j	25·0 Cc.
Aquam Cinnamomi	ad	℥vj	ad 150·0 Cc.

Ft. mist. statim.

Cap. ʒij omn. quadrant. hor. donec hæmorrh. cessav.

Take a perfectly dry bottle (if not dry, wash out with alcohol); put the tragacanth into the bottle, add the oil of turpentine, and mix thoroughly by gentle agitation; add quickly about half the cinnamon water, and shake vigorously; add the syrup and the remainder of the cinnamon water in portions, shaking after each addition.

Chloroform and most other limpid organic liquids can be emulsified in a similar way.

Seed emulsions.—Oily seeds when rubbed with water form an emulsion, the albumen in the seed acting as an emulsifying agent for the oil. The addition of a little gum acacia improves the emulsion, and this is generally included in the prescription. Mistura Amygdalæ B.P. and Emulsum Amygdalæ U.S.P. are examples of this class. The formula for the latter is:

℞

Amygdalæ Dulcis .	.	ʒiij	12 Gm.
Sacchari . . .	.	ʒiss	6 Gm.
Acaciæ Gummi .	.	ʒss	2 Gm.
Aquam . . .	ad	℥vj	ad 200 Cc.

Ft. mist.

Cap. ℥ss t. i. d. p. c.

[Blanch the almonds, add the sugar and gum acacia, and beat until thoroughly mixed. The powder is provided.] To the powder add sufficient water to produce a thin paste, and triturate until a uniform mixture results (this takes some time). Gradually add the bulk of the water, triturating after each addition. Strain through fine muslin into the bottle. Use the remainder of the water to wash out

the mortar, and pour it through the strainer into the bottle. Mix by shaking vigorously.

Alkalies.—These will only emulsify substances (fixed oils, resins) with which they can form soaps. Most commercial fixed oils contain a trace of fatty acid, and when an aqueous solution of a caustic alkali is added to them and the mixture shaken emulsification occurs, because the alkali combines with the acid and forms a soap, which acts as an emulsifying agent. If the fixed oil is free from fatty acid, emulsification does not occur (see page 134).

Mix equal parts of decinormal caustic soda and commercial olive oil, and equal parts of the caustic-soda solution and the purified olive oil, and shake. Allow to stand one hour, and note the result.

The use of alkalies as emulsifying agents for internal medication is limited (page 134). They are most commonly used for the oleo-resin copaiba.

℞

Copaibæ . . .	ʒiij	12 Cc.
Liquoris Potassæ . .	ʒij	8 Cc.
Syrupi	℥j	32 Cc.
Aq. Menthæ Piperitæ	ad ℥vj	ad 200 Cc.
Ft. mist.		

Sig. Coch. ampl. ter in die post cibum sumendum.

Pour the potash liquor into the bottle, add an equal quantity of peppermint water, and mix; add the copaiba and shake until emulsification is completed; gradually add the remainder of the peppermint water and the syrup, shaking after each addition. This emulsion separates relatively quickly, but is easily diffused by shaking.

Saponins.—Aqueous solutions of saponins will form an emulsion with any fluid immiscible with water.

Dilute tincture of quillaia with an equal bulk of water, and to a portion add an equal volume of olive oil, oil of turpentine, and liquid petroleum respectively. Shake vigorously and note the result after allowing to stand one hour.

Besides immiscible liquids, immiscible solids (resins, oleo-resins) require an emulsifying substance for their uniform diffusion through water. For resins dry gums are usually prescribed, and in this case the powdered resin and gum are intimately mixed in a mortar and then rubbed to an emulsion with sufficient excipient to form a thin paste. Afterwards the other ingredients of the prescription are added. Mistura Guaiaci B.P. is an example with tragacanth.

℞

Guaiaci Resinæ . .	gr. xxij	1·5 Gm.
Sacchari Purificati . .	gr. xxij	1·5 Gm.
Pulv. Tragacanthæ . .	gr. vij	0·4 Gm.
Aq. Cinnamomi . .	℥iv	100·0 Cc.
Ft. mist.		

Sig. ℥ss t. d. s. p. c.

Triturate the guaiacum resin, tragacanth, and sugar until intimately mixed. Gradually add the cinnamon water, triturating after each addition until a uniform mixture results.

Gum-resins, which, as their name implies, consist of gum and resin, only need trituration with water to form an emulsion. The only difficulty in

dispensing these is in powdering the gum-resin. At ordinary temperatures gum-resins are somewhat tenacious, and it is therefore advisable to make the gum-resin and pestle and mortar as cold as possible. Unless this is done the preparation of the emulsion is liable to be somewhat protracted. Mistura Ammoniaci B.P. and Mistura Asafetidæ U.S.P. are examples of this form of emulsion.

℞

Ammoniaci . . .	gr. cx	5 Gm.
Syrupi Tolutani . . .	℥ss	10 Cc.
Aquam Destillatam .	ad ℥viij	ad 160 Cc.
Ft. mist.		

Cap. ℥ss t. i. d. i. c.

Powder the ammoniacum as well as possible. Add a little water and triturate to form a thin paste. Gradually add the remainder of the water and the syrup of tolu, triturating until a uniform emulsion is produced. Strain through fine muslin into the bottle.

Resinous tinctures when mixed with water deposit the resin, which generally coheres to form lumps. To keep the resin uniformly diffused the prescriber usually introduces an emulsifying or suspending agent into the prescription. Mucilage of acacia is the best agent, but syrup and glycerin in considerable quantities are also efficient.

℞

Tincturæ Tolutanæ . .	ʒj	4 Cc.
Mucilaginis Acaciæ . .	℥ss	16 Cc.
Aquam . . .	ad ℥iv	ad 120 Cc.

Put the mucilage into the bottle, dilute with twice the quantity of water, mix, and allow the fluid

to flow round the sides of the bottle. Pour in the tincture of tolu in portions, and diffuse through the dilute mucilage by gentle shaking. Add the remainder of the water in portions, shaking slightly after each addition.

Repeat the mixture, using syrup (one ounce or 30 Cc.) or glycerin (one ounce or 30 Cc.) in place of mucilage of acacia, but dilute in the first place with an equal volume of water only.

The oleo-resin or liquid extract of male fern is frequently prescribed as a draught, and it affords a further useful example in the art of emulsion making. Like oleo-resins in general, it requires much more emulsifying agent than a fixed oil.

℞

Extracti Filicis Liquidi .	ʒiss	6 Cc.
[Oleo-resinæ Aspidii U.S.P.]		
Mucilaginis Acaciæ . .	℥ss	15 Cc.
Syrupi Aurantii . . .	℥ss	15 Cc.
Aquam Cinnamomi . ad	℥iss	ad 50 Cc.
Ft. haust.		

Sig. Primo mane sumendus.

Put the mucilage into a mortar and add by degrees the liquid extract (oleo-resin) of male fern, completely emulsifying each addition. Add two drachms (8 Cc.) of cinnamon water in two portions, then the syrup, and pour into the bottle. Afterwards add sufficient cinnamon water to make the required quantity.

Repeat, using half a yolk of egg in place of the mucilage. Milk has been recommended as an emulsifying agent for this drug, but in the author's hands it has proved a complete failure.

Lotiones—Linimenta

These are dispensed in a similar manner to mixtures. The bottles in which they are placed, however, should be of a distinguishing shape (triangular, hexagonal, etc., in section) and colour (green or blue), and a label 'for external use only' should be put upon them.

The following will suffice as examples:

℞

Liq. Plumbi Subacetatis Fortis				
Alcoholis . . .	āā	℥ss	āā	16 Cc.
Aquam Destillatam .	ad	℥xij	ad	400 Cc.
Ft. lotio.				

Sig. Frequent. applic. ut dict.

This may be mixed in any way. The student should see that the lead subacetate solution is clear and fresh (when kept it absorbs carbon dioxide from the air and lead carbonate is deposited), and the lotion when dispensed should only be slightly turbid. It becomes more so by keeping.

℞

Zinci Oxidi		℥ss		12·0 Gm.
Ferri Peroxidi . . .		gr. iij		0·18 Gm.
Glycerini		℥ss		12·0 Cc.
Aquam Rosæ . .	ad	℥iv	ad	100·0 Cc.
Ft. lot.				

Sig. Ter in die adhib.

Mix the zinc oxide and iron peroxide in the mortar; add sufficient rose water to form a paste, then the glycerin, and afterwards more rose water, until the mixture is sufficiently dilute to pour into

the bottle. Use the remainder of the rose water to wash the residue in the mortar into the bottle.

℞

Liquoris Ammoniæ . .	℥j	25 Cc.
Olei Amygdalæ Expressi .	℥j	25 Cc.
Olei Olivæ	℥ij	50 Cc.
Ft. linimentum.		

Sig. Nocte maneque applicandum.

Measure the three ingredients into a bottle and shake. Emulsification is quickly completed. (This is Linimentum Ammoniæ B.P.)

℞

Olei Terebinthinæ . .	℥ij	50·0 Cc.
Acidi Acetici Glacialis .	℥ss	12·5 Cc.
Camphoræ	℥ss	12·5 Gm.
Olei Olivæ	℥ij	50·0 Cc.
Ft. lin.		

Sig. Part. dolent. om. vesp. infricand.

Dissolve the camphor in the olive oil or oil of turpentine; add the other ingredients; mix by shaking. The liniment is a clear liquid. (It is approximately Linimentum Terebinthinæ Aceticum B.P.)

℞

Olei Terebinthinæ . .	℥j ʒv	52 Cc.
Camphoræ	ʒj	4 Gm.
Saponis Mollis . . .	ʒiss	6 Gm.
Aquæ	ʒv	20 Cc.
Ft. lin.		

Sig. More dicto utendum.

This liniment (Lin. Terebinthinæ B.P.) may be prepared in two ways, corresponding in some

respects to the two methods of making gum emulsions (page 260). The soap is the emulsifying agent.

1. Put the soap in a mortar; add half a drachm of water and triturate until a uniform foamy mixture is obtained. Dissolve the camphor in the oil of turpentine and add about one drachm (4 Cc.) to the soap mixture. Triturate until emulsification is complete. Add the remainder of the turpentine and camphor in small portions, emulsifying each, and lastly the remainder of the water.

2. Dissolve the camphor in the oil of turpentine in a wide-mouthed bottle; add the soap, and shake vigorously until particles of soap are no longer visible. Add the water in portions, shaking vigorously after each addition, until a homogeneous mixture is produced. This method is much quicker than the first, but sometimes the liniment separates into two portions on standing. Renewed shaking, however, produces a permanent emulsion.

Pulveres

The dispensing of powders rarely presents any difficulty. The individual constituents should be finely powdered, and the whole intimately mixed before each powder is weighed out. Generally the mixing of powders is best done on a sheet of paper with a spatula, afterwards passing the powder through a sieve, but occasionally, especially for substances which do not mix readily with water (*e.g.*, sulphur) and substances readily soluble in water, mixing by pestle and mortar is better. The former

method gives a light powder, the latter a more compact one. If small quantities of powerful drugs have to be mixed with bulky powders, the active drug should first be intimately mixed with a small amount of the less active or diluent powder, and this in turn with more of the diluent powder until a mixture of sufficient bulk to allow of safe admixture with the remainder of the diluent powder is obtained.

℞

Rhei Radicis . . .	ʒj	4 Gm.
Magnesiæ . . .	ʒiij	12 Gm.
Zingiberis	ʒss	2 Gm.

Ft. pulvis. Divide in part. æq. ix.

Capiat pulverem ter in die horis duabus post cibos.

Mix the powders on a sheet of paper with a spatula until a uniform mixture is produced. Sieve, weigh nine powders of 30 grains (2 Gm.) each, and put them on powder papers. Fold in the manner demonstrated. Place the powders in a cardboard box of appropriate size; label.

℞

Sodæ Tartaratæ . . .	ʒij	7·77 Gm.
Sodii Bicarbonatis . .	gr. XL	2·59 Gm.

Ft. pulv. Invol. in chart. cærul. Mit. tal. pulv. vj.

Acidi Tartarici . . .	gr. xxxviij	2·46 Gm.

Ft. pulv. Invol. in chart. alb. Mit. tal. pulv. vj.

Sig. Pulv. primo mane sum. Solve pulv. in chart. cærul.; add. pulv. in chart. alb. et in actu efferves. bib.

[In practice this powder (so-called seidlitz powder) would be prescribed M. Pulveres Sodæ

Tartaratæ Effervescentes vj (Pulveres Effervescentes Compositos vj U.S.P.).]

The individual ingredients must be dry and in fine powder. The potassium sodium tartrate and sodium bicarbonate may be weighed in bulk, intimately mixed, and 160 grains (10·36 Gm.) of the mixture weighed and placed on blue powder papers; or the quantity for each powder may be weighed separately and the two ingredients mixed before folding the paper. The latter method is quicker for a small number of powders. The tartaric acid is then weighed and folded in white papers. Place the powders, a blue and a white alternately, in an appropriate box. Prepare a draught for administration, and after effervescence has ceased test the reaction of the solution. It is slightly acid.

Pilulæ

The main difficulty in making pills is the production of a pill mass of proper consistence (see page 174). This is largely a matter of experience, but the consistence required may be likened to that of clay. The active ingredients should be intimately mixed previous to the addition of the excipient; and all solid substances should be in the finest possible state of powder. If a small fraction of an active drug has been ordered, special means may require to be taken to obtain the correct dose in each pill.[1] Excipients are dealt with on pages 176–184.

[1] If twenty-four pills containing $\frac{1}{60}$ grain arsenious acid have been prescribed, the simplest method of obtaining the correct quantity of arsenious acid is to weigh 1 grain (and less

℞.

Rhei Radicis .	. gr. lxxij	4·7 Gm.	18
Aloes Socotrinæ	- gr. liv	3·5 Gm.	5
Myrrhæ			
Saponis Duri .	. āā gr. xxxvj	āā 2·6 Gm.	6
Olei Menth. Piper. .	. ♏v	0·3 Cc.	♏ 1
Syrupi Glucosi	. . ʒj	4·0 Gm.	♏ 10

Ft. massa. Div. in pil. xxiv. 4 — 27

Sig. Pilula alter. noct. sum.

(This is the Pilula Rhei Composita B.P.)

Weigh the solid ingredients in fine powder and put them into a mortar; add the oil of peppermint and triturate until a uniform mixture is obtained. Add the syrup of glucose and knead with the pestle until a mass is formed. Transfer this to a 5-grain pill machine, the slab of which has been dusted with lycopodium or marshmallow powder, and roll the mass into a uniform pipe the width of the cutter of the machine. (The ordinary machine makes twenty-four pills.) Cut the pipe into pills in the manner demonstrated. Dust the pills with a little French chalk and finish them with the pill-rounder (French chalk is not used if the pills are to be coated). Put them into a pill box of appropriate size.

The following (Pilula Quininæ Sulphatis B.P.) is an example of a pill mass made with glycerin and tragacanth. The tartaric acid plays a subsidiary part. Theoretically a trace of water is necessary; a sufficient quantity is usually taken up by the glycerin from the air.

than this should not be weighed on ordinary dispensing scales), mix it with 59 grains of inert powder (*e.g.*, milk sugar), and take 24 grains of the mixture to make the pills.

℞

Quininæ Sulphatis	. .	gr. xxx	2·0 Gm.
Acidi Tartarici	. . .	gr. j	0·065 Gm.
Glycerini	. . . .	gr. iv	0·26 Gm.
Tragacanthæ	. . .	gr. j	0·065 Gm.

Ft. mas. Div. in pil. xij.

Sig. Pil. duæ om. noct. sum.

Mix the powdered quinine sulphate and tartaric acid thoroughly in a small mortar. Mix the glycerin and tragacanth on a porcelain slab and transfer it to the end of the pestle. Knead until a uniform mass is produced. Roll the mass and cut it into pills in the manner previously shown.

Pill coating is referred to on page 189. The various methods are more easily demonstrated than described.

Unguenta

Ointments are usually best mixed on a porcelain slab by means of a flexible spatula; they may, however, be prepared in the mortar. Every endeavour should be made to produce an ointment as smooth and uniform as possible. Solid substances should be reduced to the finest powder before being incorporated with the fatty vehicle; if very soluble in water, oleic acid, or other innocuous fluid, they may with advantage be dissolved in this before being mixed with the excipient; extracts should be rubbed with water or dilute alcohol to a cream, etc. Waxes require melting; the other ingredients of the ointment, previously mixed, if necessary, are added to the melted wax, and the whole stirred until cold.

Ointments should be sent out in containers of porcelain or other impervious material. Compressible metallic tubes are convenient and clean to use.

Compare the miscibility of wool-fat, lard, and soft paraffin for water, olive oil, and glycerin respectively; and of a mixture of wool-fat (1) and almond oil (3 and 4), and a mixture of white wax (3) and almond oil (7), for water.

℞

Acidi Borici . . .	ʒj	4 Gm.
Unguentum Paraffini . .	ʒix	36 Gm.
Ft. unguentum.		

Sig. More dicto utendum.

The boric acid must be in finest powder. Place the acid and the paraffin ointment on a porcelain slab and mix thoroughly by means of a spatula. Introduce into an ointment pot, and label.

℞

Acidi Salicylici . . .	ʒj	4 Gm.
Alcoholis	ʒss	2 Cc.
Glycerini	ʒss	2 Cc.
Ceræ Albæ	ʒiij	12 Gm.
Olei Amygdalæ . . .	ʒvij	28 Cc.
Ft. ung.		

Sig. Semel in die super linteum adhibendum.

Melt the white wax with gentle heat and add the almond oil. Dissolve the salicylic acid in the alcohol and glycerin in a mortar; add the oil and wax mixture, and stir until it congeals.

℞

Cocainæ	. . . .	gr. iv	0·25 Gm.
Acidi Oleici	. . .	gr. xvj	1·0 Gm.
Adipis	. . . .	gr. lxxx	5·0 Gm.

Ft. ung.

Sig. Nocte maneque oculis applicand.

Dissolve the cocaine in the oleic acid in a small evaporating dish, using not more than gentle heat. Add to the bulk of the lard on an ointment slab and mix. Use the remaining lard to cleanse out the evaporating dish; add to the former portion and mix the whole thoroughly.

Suppositoria

These must be of such a size, shape, and consistence as will admit of their easy introduction into the mucous cavity, and must be prepared with an excipient which will dissolve in the mucous secretion or melt below the temperature of the body. Oil of theobroma is the excipient generally prescribed; occasionally glycerinated gelatin is used. In either case the active medicament must be uniformly diffused in the finest possible state through the excipient; solid ingredients must be reduced to fine powder, and extracts must be softened with water or diluted alcohol. If the prescription contains ingredients which will diminish materially the consistence of the suppository (*e.g.*, phenol and its allies in the case of oil of theobroma suppositories), a small amount of wax or other substance, even if not present in the prescription, must be added to counteract this. The melting

point of the suppository, however, must not be raised above 98° F. (36·4° C.).

℞

Acidi Tannici . . .	gr. iij	0·2 Gm.
Olei Theobromatis . .	gr. xij	0·8 Gm.

Fiat suppos. anal. Mit. tal. sup. vj.

Sig. Suppos. sext. qq. hor. adhib.

Lubricate the suppository moulds with a little olive oil on cotton wool and place the apparatus on ice or in a dish containing sufficient cold water to reach nearly to the top.

Calculate the quantity of ingredients required for $6\frac{1}{2}$ suppositories. Weigh out the tannic acid, previously reduced to very fine powder, and put it on a porcelain slab. Shred (if necessary) and weigh the oil of theobroma, and just melt it in an evaporating dish with gentle heat. Pour half of the melted oil of theobroma on to the tannic acid, and mix the two with a spatula. Add the mixture to the oil of theobroma in the dish, and stir until the mixture begins to congeal. Pour into the suppository moulds. After an hour remove the suppositories and put them into a cardboard box lined with cotton wool.

The suppositories may also be made by mixing the tannic acid with half the calculated quantity of oil of theobroma, adding this to the other half previously melted, and proceeding as above.

Or the suppositories may be made without heat by mixing the tannic acid with the grated oil of theobroma, adding a few drops of expressed oil of almond, and kneading until a homogeneous plastic

mass is obtained. The mass is then rolled out to a cylinder, and divided into six equal parts, each part being subsequently moulded by the fingers to the proper shape.

Emplastra

With the exception of blisters (see below) these are rarely prescribed to be spread by the pharmacist (see page 235). To be done successfully the operation requires a certain degree of manual dexterity, and this is only acquired by practice.

Plasters are made of various shapes according to the part of the body to which they are to be applied; and they are usually spread upon soft white leather (plaster leather) or cotton cloth, although silk, swansdown, and other materials are occasionally used. For teaching purposes cartridge paper is efficient.

Various methods of spreading a plaster are in vogue, all of them efficacious in competent hands, but the following is perhaps the simplest and best for beginners :

M.

Emplastrum Plumbi 6″ × 4″ (15 cm. × 10 cm.) pro latere.
Signetur, More dicto utendum.

Cut the proper shape out of cardboard. Damp one side and lay it upon a piece of cartridge paper having a sufficient margin. Melt ¾ ounce of lead plaster with gentle heat, and when just melted pour into the previously prepared shape. Spread rapidly and evenly with a warm spatula or plaster iron. (The spatula or plaster iron should not be too hot or it will burn the plaster.) When set remove the

plaster shape, trim the cartridge paper, leaving a margin of ¾ to 1 inch around the plaster, and cover with a piece of waxed paper. Plasters may be spread on leather or cotton in a similar way. In the case of leather it is advisable to smooth out creases with a warm spatula before putting on the shape, and this should be tacked, with the underlying leather, to a loose board.

Blisters.—Emplastrum Cantharidis (or Empl. Mylabridis) when spread is termed a blister because it is used for blistering. A blister rarely exceeds 4 square inches in size, and is generally much smaller than this. It is usually made rectangular in shape except for behind the ears, when it is made of a curved pear-shape, the shape for each side being indicated by the space enclosed when the tips of the thumb and forefinger of the corresponding side are opposed.

The cantharides plaster is soft at ordinary temperatures and is not decidedly adhesive, hence it is spread without heating on adhesive plaster. The proper shape is cut out of paper or thin cardboard, and is laid on a sufficiently large piece of adhesive plaster. The cantharides plaster is then spread by means of the thumbs or a spatula until a thin uniform coating is obtained. The support is afterwards trimmed, a margin of ⅜ inch (5 mm.) or thereabouts being left to secure adhesion to the skin when applied.

M.

Emplastrum Cantharidis pro aure dextra.

Sig. Mor. dict. applic.

Capsulæ

Those in common use are cachets (rice paper capsules) and hard and soft gelatin capsules. They are used mainly for administering drugs with a disagreeable taste.

Cachets (capsulæ amylaceæ) can be used only for non-deliquescent powders.

℞
1 – 10c. Quininæ Sulphatis . . gr. v 0·32 Gm.
Ft. pulv. et dispens. in caps. amylac. Mitte vj.
Cap. j om. nocte.

Powder sufficient quinine sulphate in the mortar. Arrange six half-cachets of appropriate size in the cachet machine provided, and place in each 5 grains (0·32 gramme) of the powder, taking care that none is spilled on the rims of the cachets. Insert corresponding half-cachets in the lid of the machine, damp the rims of these with a water-damped roller, and close the machine with slight pressure to cause the two halves of the cachets to adhere. Remove the cachets from the machine and put them into a white box of appropriate size.

Soft gelatin capsules (capsulæ gelatinosæ flexiles) are used for organic liquids. Aqueous liquids cannot be dispensed in them owing to the water swelling and softening the gelatin.

℞
Copaibæ . . . . . ♏x 0·6 Cc.
Ponat. in caps. gel. flex. et mit. tal. caps. no. xij.
Cap. j t. i. d. p. c.

Cut off the necks of twelve soft gelatin capsules having a capacity of ten minims and place them in the support provided. Fill the capsules by means of a syringe, taking care that none of the copaiba touches the cut neck of the capsule. Close the capsule by allowing a drop of hot liquid gelatin solution to fall from a glass rod on to the open end of the capsule. After the gelatin has set dip the end in a warm gelatin solution to give it a smoother appearance. Put the capsules into a cardboard or chip box.

Hard gelatin capsules (capsulæ gelatinosæ operculatæ) may be used for non-aqueous liquids or for solids.

℞

Creosoti	♏j	0·06 Cc.
Olei Cinnamomi . .	♏iv.	0·24 Cc.

Misce et pone in caps. gel. operc. Mit. tal. cap. vj.

Cap. j post sing. cib.

Mix the creosote and oil of cinnamon, and by means of a syringe introduce 5 minims of the mixture into each of six hard gelatin capsules of appropriate size from which the caps have been removed. Damp the necks of the capsules with water and replace the caps. The water softens the gelatin of the two opposed surfaces, and the capsules are thus hermetically closed.

Prescriptions Involving Chemical Change

Not infrequently prescriptions are written with the intention of obtaining chemical change during their dispensing. Examples of this occur in most

Pharmacopœias. In the B.P. are Lotio Hydrargyri Flava, Lotio Hydrargyri Nigra, Mistura Ferri Composita, and Pilula Ferri; in the U.S.P. are Massa Ferri Carbonatis, Mistura Ferri Composita, Pilulæ Ferri Carbonatis, and Pilulæ Ferri Iodidi.

℞

Ferri Sulphatis . . .	gr. x	0·6 Gm.
Potassii Carbonatis . .	gr. xij	0·7 Gm.
Myrrhæ		
Sacchari . . .	āā gr. xxiv	āā 1·5 Gm.
Spiritus Myristicæ . .	♏xx	1·1 Cc.
Aquam Rosæ . . ad	℥iv	ad 100·0 Cc.

Ft. mist. secund. art.

Sig. ℥ss t. d. s. p. c.

Powder the myrrh in a mortar; add the potassium carbonate and sugar, and mix. Triturate with sufficient rose water to form a thin paste, and gradually add more rose water until 3 ounces has been added and a uniform mixture has been produced. Transfer to the bottle and add the spirit of nutmeg. Dissolve the ferrous sulphate in ½ ounce of rose water and add it to the contents of the bottle; shake. Add sufficient rose water to make 4 ounces. This is Mistura Ferri Composita B.P.

℞

Potassii Chloratis . .	ʒj	4 Gm.
Acidi Hydrochlorici . .	ʒj	4 Cc.
Aquam . . . ad	℥vj	ad 200 Cc.

Ft. collutor. secund. art.

Sig. Frequent. mor. dict. utend.

This prescription might be dispensed in two ways with different results. As the prescriber has

ordered strong hydrochloric acid it is evident that he intends it to interact with the potassium chlorate, and produce a solution of chlorine (and chlorine peroxide). Therefore weigh powdered potassium chlorate and put it into a 6-ounce (or 200-Cc.) bottle; add the hydrochloric acid, cork, and allow to stand five minutes. Add the water in portions, shaking after each addition. The mixture is a solution of chlorine, chlorine peroxide, potassium chlorate, and hydrochloric acid, and is of a greenish yellow colour.

If the potassium chlorate is dissolved in half the water and the hydrochloric acid in the other half, and the two are mixed, only a trace of chlorine is formed and the mixture remains colourless; it is a solution of its two ingredients. Chlorine and chlorine peroxide are very gradually formed on keeping, but the mouth wash would probably be used before much decomposition occurred.

If the prescriber order dilute hydrochloric acid in the prescription, no blame can be attached to the dispenser if he assumes (supposing the prescriber to be inaccessible) that as little decomposition as possible is required.

℞

Hydrargyri Subchloridi .		gr. xxx	1·37 Gm.
Glycerini		℥ss	10·0 Cc.
Mucilaginis Tragacanthæ .		℥j ʒij	25·0 Cc.
Liquorem Calcis .	ad	℥x	ad 200·0 Cc.

Ft. lot.

Sig. Part. affect. mane et vesp. applicand.

Put the calomel, glycerin, and mucilage into the mortar and mix. Add 2 ounces of lime-water,

and triturate. Pour into a bottle and add the remainder of the lime-water in portions, shaking after each addition. This is Lotio Hydrargyri Nigra B.P.

℞

Chloral. Hydrat.			
Menthol. . . .		āā ʒj.	āā 4 Gm.
Ft. pigm.			

Sig. Part. dol. alt. dieb. admov.

Rub the chloral hydrate and menthol together in a mortar until the mixture has become liquid.

Chemical incompatibility in which chemical change not intended by the prescriber occurs in dispensing is dealt with on page 75, and examples are given on page 288 *et seq.* (The latter should be studied in connection with dispensing.) In some cases incompatibility results from decomposition having occurred in drugs or preparations themselves. The following is an interesting example :

℞

Potassii Iodidi . . .		ʒij	8 Gm.
Spir. Ætheris Nitrosi .		℥ss	15 Cc.
Syrupi Tolutani . . .		℥j	30 Cc.
Aquam Chloroformi .	ad	℥viij	ad 250 Cc.
Ft. mist.			

Sig. ℥ss 4^{ta} qq. hor. sum.

Sweet spirit of nitre decomposes by keeping and becomes acid, hence when an ordinary specimen is taken from a stock bottle and added to the potassium iodide solution, nitrous acid and hydriodic acid are first formed in the solution, but these decompose each other and liberate free iodine—

$$HNO_2 + HI = I + NO + H_2O.$$

The sweet spirit of nitre must therefore be neutralised—a solution of potassium carbonate or bicarbonate may be used—before being mixed with the potassium iodide. A colourless mixture will then result. [Decomposition, however, gradually occurs owing to hydrolysis, etc., of the spirit. The mixture requires a small quantity of alkali, and this should be pointed out to the prescriber.]

EXAMPLES OF INCOMPATIBILITY

Physical Incompatibility

℞

Ol. Morrhuæ	℥ij
Acaciæ Gummi	ʒj
Syrupi	℥j
Aq. Cinnamomi	ad ℥vj

Ft. emul. ℥ss t. d. s. p. c.

The quantity of gum is insufficient to emulsify the oil. Half an ounce of gum is advisable.

℞

Copaibæ	ʒiij
Spir. Juniperi	ʒiij
Glycerini	℥ss
Syrup. Aromat.	℥j
Aquam	ad ℥vj

Ft. mist. ℥ss t. d. s. p. c.

The copaiba requires an emulsifying agent—a mucilage or a caustic alkali, or both.

℞

Acid. Carbolici	ʒj
Aquæ	℥j

Ft. lot. Nocte maneque adhib.

Phenol is insoluble in eight parts of water; at least thirteen is required. A lotion of the prescribed strength could be prepared by substituting 1½ drachms of glycerin for the same quantity of water.

℞

Chloroformi	ʒj
Glycerini	℥ss
Aq. Cinnam.	ad ℥ij

Ft. haust. Primo mane sum.

The chloroform is insoluble in the menstruum, and is not properly suspended by the glycerin. Acacia or tragacanth is required to make an emulsion. The dose of chloroform is excessive. The draught is evidently intended as an anthelmintic.

℞

Ol. Terebinthinæ	ʒj
Syrupi	℥j
Aq. Menth. Pip. . . .	ad ℥iij

Ft. mist. ℥ss om. hor. sum.

The oil of turpentine requires a gum for its proper suspension and diffusion.

℞

Atropinæ Sulphatis	0·1 Gm.
Olei Ricini	10·0 Cc.

Ft. sol.

Alkaloidal salts generally are insoluble in fixed oils and fats. The base should have been prescribed.

℞

Cocainæ Hydrochl.	gr. xx
Collodii Flexilis	℥ss

Ft. pigment. More dicto utend.

The salt is insoluble in the menstruum. Cocaine should have been ordered.

℞

Tinct. Cannabis Ind.	
Mucilag. Acaciæ	āā ℥ss

Ft. mist. ʒj om. noct. sum.

The alcohol precipitates the gum. Water should have been ordered as a diluent and the dose proportionately increased.

℞

Tinct. Ferri Perchlor. . . .	ʒvj
Mucilag. Acaciæ	
Glycerini	āā ℥ij
Aquam	ad ℥viij

Ft. gargarisma. Post sing. cib. utend.

This mixture is not strictly incompatible. The tincture of ferric chloride and the mucilage form a gelatinous mass if mixed together, but if properly dispensed the mixture is clear and of syrupy consistence. It is too viscous to gargle properly, and more water (with more of the tincture if necessary) should have been ordered, or the mucilage omitted.

℞

Boracis	ʒvj
Mucilag. Acac.	℥j
Aq. Menth. Pip. . . .	ad ℥viij

Ft. mist. Cap. ℥ss t. i. d.

Presumably the mucilage is intended to suspend the undissolved borax, but translucent flocculent masses are formed owing to the interaction of the mucilage and the borax. A satisfactory mixture can be obtained with twice the amount of water prescribed.

℞

Potassii Citrat.	ʒss
Spt. Æther. Nit. . . .	ʒij
Syr. Tolut.	ʒiij
Aquam	ad ℥iss

Ft. mist. ʒj tert. qq. hor. sum.

The strongly saline liquor produced by dissolving the salt in the water will not mix with the spirit, which consequently swims at the top.

℞

Chloral. Hydrat. . . .	ʒiij
Potass. Brom.	ʒiij
Syr. Aromat.	ad ℥ij

Ft. mist. ʒj om. noct. sum.

Separation into two layers occurs. The upper layer consists mainly of chloral alcoholate, which is formed by the

alcohol in the syrup displacing the combined water of the hydrate. A syrup containing no alcohol should have been ordered.

℞

Magnesiæ	ʒiij
Aq. Menth. Pip. . . .	℥ij

Ft. mist. ʒj t. d. s.

The magnesia soon sets to a solid mass which cannot be disintegrated by shaking. The addition of another insoluble solid largely prevents this.

℞

Chloral. Hydrat.	
Sulphonal.	āā gr. xv

Ft. pulv. Pone in caps. amyl. M. t. vj. Altern. dieb. sum.

The two ingredients when triturated form a soft pasty mass. The prescription could be dispensed in cold weather by gentle mixing, but it must be regarded as incompatible.

℞

Phenol.	
Camphoræ . . .	āā gr. ij
Ext. Taraxaci	q.s.

Ft. pil. Mitte tal. pil. xxiv. Cap. t. i. d. p. c.

Phenol and camphor when triturated form a liquid. The pill can be dispensed by employing an inert powder, but it is somewhat bulky and is otherwise objectionable.

℞

Tinct. Opii	ʒj
Tinct. Tolut.	ʒiij
Aq. Menth. Pip. . . .	ad ℥vj

Ft. mist. ℥ss quart. qq. hor. sum.

The resin of the tincture of tolu is precipitated and gradually collects at the bottom of the bottle, from which it cannot be separated by shaking. A small quantity of mucilage or a

larger quantity of syrup is necessary to ensure diffusion of the resinous particles (*cf.* page 268).

℞
Guaiaci Resinæ . . . . ʒiss
Vini Colchici . . . . ʒiij
Spir. Chlorof. . . . . ʒij
Aquam . . . . . ad ℥viij
Ft. mist. ℥j t. d. s.

Mucilage or other emulsifying agent is required to suspend the resin.

Chemical Incompatibility

℞
Hydrarg. Perchlor. . . . gr. j
Potassii Iodidi . . . . ʒij
Inf. Cinchon. Acid. . . . ℥viij
Ft. mist. ℥ss t. d. s.

The double iodide formed by the interaction of the mercuric chloride and potassium iodide precipitates the alkaloids in the infusion.

℞
Quininæ Sulphat. . . . gr. xij
Acid. Sulphur. Arom. . . ♏xx
Inf. Krameriæ . . . . ad ℥viij
Ft. mist. ℥ss t. d. s.

Quinine tannate is precipitated.

℞
Ferri et Quin. Cit. . . . ʒj
Potassii Iodidi . . . . ʒiij
Aq. Chloroformi . . . ℥vj
Ft. mist. ℥ss quart. qq. hor. sum.

A precipitate, partly reddish amorphous, but mainly of colourless crystals, occurs on standing. The former is probably herapathite, the latter quinine iodide.

℞

Tinct. Cinchonæ . . .	ʒij
Spir. Ammon. Arom. . .	ʒiij
Spir. Chloroformi . . .	ʒij
Aquam	ad ℥viij

Ft. mist. ℥j t. d. s. a. c.

The aromatic spirit of ammonia precipitates the alkaloids in the tincture of cinchona. The precipitate is readily diffused by shaking.

℞

Quininæ Sulphatis . . .	gr. xij
Ext. Glycyrrhizæ Liq. . .	ʒiij
Aquam	ad ℥vj

Ft. mist. ℥ss t. d. s.

The glycyrrhizin in the extract is precipitated as a dark brown unsightly mass.

℞

Liq. Morphinæ Hydroch. . .	ʒiij
Tinct. Lavand. Co. . . .	℥ss
Aquam	ad ℥iij

Ft. mist. ℥ss om. noct. sum.

A red precipitate of morphine santalate forms.

℞

Liq. Arsen. et Hydrarg. Iod. .	ʒij
Liq. Strychnin. Hydroch. . .	ʒiss
Syrup. Aromat.	℥j
Aquam	ad ℥vj

Ft. mist. ℥ss t. d. s. p. c.

The double iodide precipitates the strychnine.

℞

Potassii Iodidi	ʒiij
Strychnin. Hydroch. . . .	gr. j
Aquæ	℥viij

Ft. mist. ℥ss t. d. s.

Small crystals of strychnine iodide gradually separate on standing.

℞

Ferri et Quin. Cit.	ʒj
Potassii Citratis	ʒiij
Acidi Citrici	ʒij
Aquam	ad ℥viij

Ft. mist. ℥ss t. d. s. p. c.

A crystalline precipitate of quinine citrate separates.

℞

Sodii Salicylatis	ʒiij
Tinct. Aurant.	ʒij
Tinct. Cinchonæ	ʒiij
Aquam	ad ℥vj

Ft. mist. ℥ss 3tia qq. hor. sum.

Quinine salicylate is precipitated.

℞

Potassii Iodidi	ʒij
Spir. Ætheris Nit.	℥ss
Morphinæ Hydroch.	gr. ij
Syrupi	℥ss
Aq. Menth. Pip.	ad ℥iv

Ft. mist. ʒij 4ta qq. hor. sum.

Sweet spirit of nitre becomes acid by keeping, and is usually acid when dispensed. The free nitrous acid thus formed interacts with the potassium iodide, and iodine is liberated, which precipitates the morphine.

℞

Auri et Sod. Chlor.	gr. j
Strychnin. Hydroch.	gr. ss.
Syrup. Aromat.	ʒj
Aquam	ad ℥vj

Ft. mist. ℥ss t. d. s. p. c.

The strychnine is precipitated by the gold salt. The addition of alcohol (about one ounce) will prevent this, but even then the gold salt is reduced by the alcohol and syrup, and is thrown down as a purplish precipitate.

℞

Liq. Plumbi Subacet. Fort. . ℥ss
Tinct. Opii . . . . . ℥ss
Aquam . . . . . . ad ℥xij

Ft. lot. More dicto utenda.

A lotion similar to this is frequently prescribed, but there are several objections to it. The alkaloids and colouring matter of the opium are precipitated by the solution of lead subacetate; but even if this were not the case the opium would exert no local action.

℞

Ammon. Carb. . . . . ʒj
Syrup. Tolut.
Syrup. Scillæ . . . . āā ℥ss
Aquam . . . . . ad ℥vj

Ft. mist. Cap. ℥ss. 4ta qq. hora.

The syrup of squill contains free acetic acid, which interacts with the ammonium carbonate, producing effervescence and forming ammonium acetate. If this is the intention of the prescriber the mixture is compatible, since it forms a clear solution.

℞

Liq. Arsenicalis . . . ʒj
Tinct. Ferri Perchlor. . . ʒij
Aq. Chloroformi . . . ad ℥vj

Ft. mist. ℥ss t. d. s. p. c.

This prescription may be regarded as compatible, but it is a bad form. The arsenical solution is alkaline and the iron solution acid, and hence some interaction occurs; but the acidity of the liquor prevents the formation of a precipitate.

℞

Liq. Arsenicalis . . . ♏iij
Syr. Ferri Iodid. . . . ʒss
Aquam . . . . . ad ℥ss

Ft. mist. Mitte uncias octo. Cap. ℥ss t. i. d. p. c.

A small precipitate of carbonate of iron, which changes to hydroxide, results owing to the presence of potassium carbonate in the arsenical liquor.

℞
Sodii Salicylatis . . . ℥ss
Syrup. Limonis . . . . ℥j
Aquam . . . . . ad ℥vj

Ft. mist. Cap. ℥ss 3^{tia} qq. hor. ex aq.

The acid syrup causes salicylic acid to be deposited.

℞
Liq. Bismuth. et Amm. Cit. . ʒj
Tinct. Calumbæ . . . ʒiij
Acid. Sulphur. Arom. . . ʒij
Aquam . . . . . ad ℥viij

Ft. mist. ℥j t. d. s. a. c.

Bismuth citrate is precipitated owing to the action of the acid on the bismuth and ammonium citrate.

℞
Tinct. Ferri Perchlor. . . ʒj
Quininæ Sulphat. . . . gr. vj
Acid. Phosphor. Dil. . . . ʒss
Glycerini . . . . . ʒiij
Aquam . . . . . ad ℥vj

Ft. mist. ℥j quat. in die sum.

Phosphate of iron is precipitated. To avoid this the quantity of phosphoric acid should be increased, or it might without disadvantage be omitted altogether.

℞
Tinct. Ferri Perchlor. . . ʒj
Tinct. Cinchonæ . . . ʒiij
Aq. Chloroformi . . . ad ℥vj

Ft. mist. Cap. ℥ss 4^{ta} qq. hor. ex aq.

A black precipitate of tannate of iron is formed, owing to the tannin present in tincture of cinchona.

℞
Bismuth. Subnit. . . . ʒiij
Mucilag. Acac. . . . . ʒvj
Tinct. Card. Co. . . . ℥ss
Aquam . . . . . ad ℥vj

Ft. mist. Cap. ℥ss t. i. d. a. c.

On standing the bismuth subnitrate and the mucilage form a gelatinous mass which cannot be dislodged from the

bottom of the bottle. Probably bismuth arabate and similar products are formed.

℞
Boracis . . . . . . gr. iij
Zinci Sulphat. . . . . gr. iij
Aq. Rosæ . . . . . . ℥j
Ft. collyrium. Nocte maneq. exhib.

A precipitate of zinc borate is formed.

℞
Boracis . . . . . . gr. XL
Liq. Hydrarg. Perchlor. . . ℥ij
Ft. lot. More dict. utend.

Borate of mercury is formed and precipitated.

℞
Argenti Nitrat. . . . . . gr. x
Aq. Rosæ . . . . . . ℥j
Ft. pigment. Quotid. applic.

Part of the silver nitrate is reduced by the oil of rose and precipitated as a blackish powder. Distilled water should have been prescribed.

℞
Hydrarg. Subchlor.
Zinci Chloridi . . . . āā gr. xij
Liq. Calcis . . . . ℥iv
Ft. lot. Exhib. bis in die.

A different result is produced according to the mode of dispensing. If the zinc chloride is added to the lime-water a white precipitate of zinc oxychloride is formed, and the addition of the calomel produces no other obvious action. If the calomel is first triturated with the lime-water the black oxide of mercury is formed: the subsequent addition of the zinc chloride produces little immediate effect, but on standing the precipitate gradually changes from dark grey to white. The lotion, however prepared, finally contains mercurous and mercuric chlorides and zinc oxychloride, and is slightly acid.

Phenazoni	. . . .	ʒij
Spir. Æther. Nit.	. . .	℥ss
Syrupi	. . . . .	℥ss
Aquam	. . . . .	ad ℥vj

Ft. mist. ℥ss quarta qq. hora sum.

The solution becomes light green, and subsequently dark green in colour, owing to the formation of isonitroso-antipyrin. The mixture, however, is therapeutically active. After standing some days it changes to a dark red colour.

℞

Sodii Salicylat. .	. . . .	ʒiij
Spir. Æther. Nit.	. . .	℥ss
Tinct. Aurantii .	. . .	ʒiij
Aquam	. . . . .	ad ℥vj

Ft. mist. ℥ss tertia qq. hora sum.

The mixture gradually becomes reddish owing to the interaction of nitrous and salicylic acids, which are formed as a result of the decomposition of the sweet spirit of nitre.

℞

Sodii Salicylat. .	. . . .	ʒvj
Spir. Ammon. Arom.	. .	ʒiv
Spir. Chlorof. .	. . . .	ʒiss
Aquam	. . . . .	ad ℥viij

Ft. mist. ℥ss t. d. s. ex aq.

The mixture gradually becomes brown in colour owing to the action of the alkaline spirit on the salicylate. Such a combination is frequently prescribed and is regarded as compatible.

℞

Chloral. Hydrat.	. . . .	ʒij
Spir. Ammon. Arom.	. .	℥ss
Aquam	. . . . .	ad ℥ij

Ft. mist. Cap. coch. parv. duo om. nocte ex aq.

The chloral hydrate is partly converted into chloral alcoholate by the alcohol of the spirit, and is partly decomposed to chloroform and a formate by the alkali.

℞

Hydrarg. Subchlor.	gr. xij
Potassii Iodidi	gr. LX

Ft. pulv. Div. in part. duodec. Cap. j nocte maneque.

The powder undergoes no change so long as it remains perfectly dry, but owing to the iodide being hygroscopic it tends to become moist. An interaction then occurs, yellow mercurous iodide being first formed. This, however, is quickly decomposed into mercury and mercuric iodide, the latter combining with the potassium iodide to form a double iodide. This prescription is a dangerous one.

℞

Liq. Iodi Fort.	♏v
Acid. Tannic.	gr. x
Glycerini	ʒij
Aquam	ad ℥j

Ft. pigment. Ter in die adhibend.

The iodine is largely converted into hydriodic acid by the action of the tannic acid.

℞

Potassii Permang.	ʒij
Glycerini	℥j
Aquam	ad ℥xvj

Ft. lot. More dicto sumend.

The glycerin reduces the potassium permanganate, manganese dioxide being formed and precipitated.

℞

Tinct. Ferri Perchlor. . . .	ʒij
Spir. Chloroformi	ʒiss
Aq. Pimentæ	ad ℥vj

Ft. mist. ℥ss t. d. s. p. c.

A brownish precipitate quickly forms owing to the action of the eugenol in the pimento water on the tincture of ferric chloride.

℞

Tinct. Iodi	ʒj
Lin. Camph. Ammon. . .	ad ℥ij

Ft. linim. Noctc mancq. adhib.

The iodine combines with the alkali of the liniment to form ammonium iodide and iodate. The reaction is generally intentional.

℞

Argenti Oxidi	gr. xij
Creosoti	♏viij
Pulv. Glycyrrh. Rad.. . . .	q.s.

Ft. massa. Div. in pil. xij. Cap. j post sing. cib.

Owing to the oxidising action of silver oxide and the ease with which the other two ingredients are oxidised, this combination is likely to lead to an explosion.

℞

Potass. Chlorat.	gr. v
Catechu	gr. x

Ft. pulv. Mitte tales pulv. octo. Cap. bis in die ante cibum.

Another example of a dangerously explosive combination.

℞

Argent. Nitrat.	gr. $\frac{1}{6}$
Acid. Arsenios.	gr. $\frac{1}{60}$
Cocain. Hydroch.	gr. $\frac{1}{4}$
Ext. Bellad.	gr. j

Ft. pil. Mitte tal. pil. xxiv. Cap. j ante sing. cib.

The changes which may occur are somewhat complex, but the most important point is the combination of an oxidising agent, silver nitrate, with readily oxidisable substances.

℞

Thymol.	gr. j
Potas. Permang.	gr. iij
Syr. Glucosi	q.s.

Ft. pil. M. t. p. xij. T. d. s. a. c.

The potassium permanganate is a powerful oxidising

agent; the other two ingredients are easily oxidisable substances.

℞

Hydrarg. Perchlor.
Sacchar. Lact. . . . . āā gr. xij

Ft. pulv. Div. in pulv. quatuor. Cap. j om. nocte.

This dose of mercuric chloride is toxic. The subchloride of mercury was meant.

APPENDICES

I

LATIN WORDS USED IN PRESC[illegible]

The Latin names in prescrip[illegible] ordinary rules of accidence. With few ex[illegible] nouns ending in a in the singular [illegible] first declension, and are feminine; those e[illegible] us are of the second declension,[1] and [illegible] masculine[3]; and those ending in um are [illegible] second declension and neuter. The [illegible] fifth declensions claim but few words. [illegible] a spirit; *ficus* (f.), a fig;[4] *fo[illegible]s* (m.), a fom[illegible]

[1] Cataplasma (a poultice), enema (a clyster), [illegible] (a gargle), gramma (a gramme), physostigm[illegible] (Cala[illegible] theobroma (the cacao tree), and a few others e[illegible] belong to the third declension and are neuter; [illegible] byne (malt), and mastiche (mastic) belong to the [illegible] clension (see page 306).

[2] Corpus (body), crus (a leg), frigus (cold), [illegible] latus (side), opus (work), pectus (breast), pondus [illegible] pus (an inflammatory exudation—matter), tem[illegible] ulcus (an ulcer), vulnus (a wound), all neuter be[illegible] third declension.

[3] Alvus (belly), carbasus (gauze), and most [illegible] ending in us are feminine; virus (poison) is neute[illegible]

[4] Ficus, like domus, has terminations [illegible] declension also.

APPENDICES

I

LATIN WORDS USED IN PRESCRIBING

THE Latin names in prescriptions follow the ordinary rules of accidence. With few exceptions, nouns ending in **a** in the singular [1] belong to the first declension, and are feminine; those ending in **us** are of the second declension,[2] and are usually masculine [3]; and those ending in **um** are of the second declension and neuter. The fourth and fifth declensions claim but few words. *Spiritus* (m.), a spirit; *ficus* (f.), a fig; [4] *fotus* (m.), a fomentation;

[1] Cataplasma (a poultice), enema (a clyster), gargarisma (a gargle), gramma (a gramme), physostigma (Calabar bean), theobroma (the cacao tree), and a few others ending in *a* belong to the third declension and are neuter; aloe (aloes), byne (malt), and mastiche (mastic) belong to the first declension (see page 306).

[2] Corpus (body), crus (a leg), frigus (cold), jus (broth), latus (side), opus (work), pectus (breast), pondus (a weight), pus (an inflammatory exudation—matter), tempus (time), ulcus (an ulcer), vulnus (a wound), all neuter, belong to the third declension.

[3] Alvus (belly), carbasus (gauze), and most names of plants ending in *us* are feminine; virus (poison) is neuter.

[4] Ficus, like domus, has terminations of the second declension also.

fructus (m.) a fruit; *haustus* (m.), a draught; *potus* (m.), a drink; *manus* (f.), a hand; and *genu* (n.), a knee, of the fourth; and *dies* (m. and f.),[1] day, and *facies* (f.), face, of the fifth, are the most important. Nearly all other substantive terminations belong to the third declension. Four ending in **on**—*hæmatoxylon, criodictyon, erythroxylon, toxicodendron*—belong to the second declension. Some names of drugs are regarded as indeclinable (see page 307).

Names of drugs.—The Latin names of drugs are given in Appendix II. At this place attention will be directed only to certain general points.

1. The Latin names of alkaloids terminate in **ina** (English, ine).[2] Consequently they belong to the first declension, and are feminine—*e.g.*, atropina, cocaina, morphina, quinina, strychnina.

2. The Latin names of (*a*) metals, (*b*) glucosides, (*c*) neutral principles, (*d*) synthetic products generally, end in **um.** They belong to the second declension, and are neuter:

(*a*) Ferrum, hydrargyrum, potassium, etc.
(*b*) Salicinum, digitalinum, etc.
(*c*) Elaterinum, picrotoxinum, santoninum, etc.
(*d*) Acetanilidum, glusidum, iodolum, etc.

3. The so-called acidic radical of a salt is latinised as follows:

[1] Meridies is always masculine.
[2] Unfortunately, considerable confusion exists regarding the nomenclature of drugs. In some Continental countries, for example, the Latin names of alkaloids end in *um*.

-ide into **-idum**—bromidum, cyanidum, iodidum, etc.

-ate into **-as**—acetas, carbonas, chloras, salicylas, etc. (all masculine).

-ite into **-is**—nitris, phosphis, sulphis, etc. (all masculine).

4. The Latin names of most other drugs end in **a** (acacia, asafetida, belladonna, calumba, cera, copaiba, ergota, galla, gentiana, ipecacuanha, krameria, morrhua, quassia, resina, sarsa, senega, terebinthina, etc.), and are of the first declension; a few belong to the third (see next page). Other terminations, however, are not infrequent:

(*a*) Belonging to the second declension:

-us—crocus, eucalyptus, hemidesmus, hyoscyamus, moschus, ricinus, strophanthus, etc. [Thus, *gen.* thuris; rhus, *gen.* rhoïs; belong to the third declension.]

-um—aconitum, amylum, cetaceum, colchicum, elaterium, gelatinum, opium, pepsinum, podophyllum, rheum, scoparium, etc.

(*b*) Belonging to the third declension:

-is (gen. *-is*)—cannabis, digitalis, hydrastis, sinapis (all feminine).

-is (gen. *-idis*)—anthemis, cantharis, colocynthis, hamamelis (all feminine).

-o (gen. *-onis*)—carbo (m.), pepo (m.), sapo (m.) (and names of certain preparations—lotio, see page 309).

-o (gen. *-inis*)—hirudo (f.), mucilago (f.).

-x (gen. *-cis*)—borax (m.), calx (f.), nux (f.), pix (f.), rumex (f.), salix (f.), styrax (m.), cortex (m. and f.), radix (f.). (Rumex and cortex change *c* into *i* in the genitive.)

-a (gen. *-atis*)—physostigma, theobroma, aspidosperma (also cataplasma, enema, gargarisma, gramma and its compounds) (all neuter).

-ol (gen. *-olis*)—eucalyptol, guaiacol, phenol, thymol (all neuter). [These are indeclinable, according to the B.P. Iodol is termed Iodolum, and safrol Safrolum, in the U.S.P.]

The following form the genitive by adding *-is*—croton, limon, æther, piper, zingiber, sulphur. Erigeron becomes erigerontis in the genitive.

Methods of forming the genitive of less frequent occurrence are—fel (fellis), mel (mellis), adeps (adipis), lac (lactis), alumen (aluminis), rhœas (rhœados), rhus (rhoïs), thus (thuris).

The declension of the following words is noteworthy:

N., Aloe; Ac., Aloen; G., Aloes; D., Aloe or Aloæ Ab., Aloe.

Mastiche (mastic) and Byne (malt) are declined in the same way.

N., Ac., Hæmatoxylon; G., Hæmatoxyli; D., Ab., Hæmatoxylo.

Erythroxylon, Eriodictyon, Toxicodendron, and Cissampelos are declined similarly.

N., Calomelas; Ac., Calomelana; G., Calomelanos; D., Calomelani; Ab., Calomelane.

Calomel is also regarded as indeclinable.

The following names of drugs are regarded as indeclinable :

Ajowan
Betel
Buchu
Cajuputi
Caoutchouc
Catechu
Cusso
Diachylon
Elemi
Gambier
Gummi
Gutta-percha
Jaborandi
Kino
Matico
Sabal
Sappan
Sassafras
Sumbul

According to the B.P., words terminating in *ol* (alcohol, salol) and words ending in *yl* (amyl, ethyl) are indeclinable. The U.S.P. forms the genitive of alcohols and phenols by adding *is* (alcohol, is; phenol, is). Chemical radicals terminating in *yl* are latinised by adding *is* (amylis, is ; ethylis, is ; glycerylis, is).

Chloral is indeclinable according to the B.P.; the U.S.P. calls it chloralum (i).

Names of medicinal forms.—1. The Latin names of most of these end in **um**. They are of the second declension and neuter. The most important are—acetum, acidum, balneum (a bath), balsamum, ceratum (a firm ointment), collodium, collunarium (a nose wash), collutorium (a mouth wash), collyrium (an eye wash), decoctum, emplastrum, emulsum (U.S.P.), extractum, fluidextractum, glycerinum (B.P.), glyceritum (U.S.P.), infusum, linimentum, oleatum (U.S.P.), oleum,

pigmentum (a paint), suppositorium, unguentum, vinum.

The following are of less importance: bacillum (a bougie), dentifricium, elæosaccharum (a trituration of sugar and a volatile oil), electuarium (a confection containing dried drugs), errhinum (an irritant snuff), emeticum, emmenagogum, fomentum, gelatum (a jelly), granulum, pessum or pessarium (a pessary), saponimentum (liniment containing soap), sudatorium (a bath to produce sweating), vaporarium (a vapour bath), vesicatorium (a blister).

2. The following names terminating in **a** belong to the first declension, and are feminine: aqua, capsula, charta, chartula (a powder wrapped in paper), conserva, gelatina (a jelly), gutta (guttæ, drops), lamella, massa, mistura, oleo-resina, pasta, pilula, tabella, tinctura.

Of less importance are: bacillula (a short, rod-shaped lozenge), bougia (a bougie), cigaretta, cigarra, emetica, escharotica (a caustic), essentia, nebula (a spray), tela (tissue).

The following names ending in **a** (gen. *-atis*) belong to the third declension, and are neuter: cataplasma, enema, gargarisma (plur. cataplasmata, etc.)

Chrisma (a stiff ointment), clysma (a clyster, enema), plasma (a non-fatty, ointment-like preparation) are not much used.

3. Words terminating in **us** are:

(*a*) Belonging to the *second* declension and masculine—pastillus, succus, syrupus, trochiscus.

Antrophorus (page 217), bolus, cereolus (a medicated bougie), globulus, sinapismus (a mustard application), stilus (a pencil), stypticus, virus. Virus is neuter.

(*b*) Belonging to the *fourth* declension and masculine—haustus (a draught), linctus (a sweet viscid preparation), spiritus, fotus (a fomentation).

4. The following words ending in **tio** (gen. *-onis*) are of the third declension and feminine—confectio, emulsio, injectio, insufflatio, lotio, solutio, trituratio.

Embrocatio, instillatio, suffumigatio (a fumigation), saturatio (an aërated water) are seldom employed.

5. Other words of the third declension are—elixir (-is) liquor (-is), oleas (-atis), oxymel (-mellis), pulvis (-eris), vapor (-is).

Adjectives relating to preparations. — Many pharmacopœial preparations are characterised by a qualifying adjective. In some cases this indicates merely the state of the preparation (*e.g.*, dilute), or the presence of an ingredient (*e.g.*, ammoniated), but in others it distinguishes the drug itself—*e.g.*, Peruvian balsam, sulphuric acid, etc. The latter class should be carefully noted, as its adjectives are often erroneously treated as nouns. This is particularly the case with the preparations of tolu and certain arsenical and antimonial preparations.

Most of the pharmacopœial adjectives have inflexions like nouns of the first and second declensions—*i.e.*, are declined like *magnus, a, um.* The remainder have inflexions like the third declension, and with few exceptions have the masculine and feminine ending in *is*, and the neuter in *e*. Two adjectives ending in *er* (niger, ruber) have three terminations in the nominative

singular; and three ending in *ns* (effervescens, recens, vesicans) have only one termination in the nominative singular.

The adjectives may be divided into the following groups (the masculine alone is given):—

i. The acid group—

Aceticus, benzoicus, boricus, citricus, hydrochloricus, hydrocyanicus, nitricus, nitrosus, phosphoricus, sulphuricus, sulphurosus, tannicus, tartaricus etc.; *e.g.*, Acidum *Aceticum*, Æther *Aceticus*.

ii. Adjectives indicating composition—

(*a*) Ammoniatus, benzoatus or benzoinatus, camphoratus, chlorinatus, phosphoratus, saccharatus, sulphuratus, tartaratus; *e.g.*, Tinctura Guaiaci *Ammoniata*, Adeps *Benzoatus* B.P. (Adeps *Benzoinatus* U.S.P.), Oleum *Phosphoratum* B.P., Calx *Sulphurata*.

(*b*) Acidus, æthereus; *e.g.*, Infusum Rosæ *Acidum* B.P., Tinctura Lobeliæ *Ætherea*.

(*c*) Hydratus (hydrated), hydrosus (hydrous); *e.g.*, Chloralum *Hydratum* U.S.P., Adeps Lanæ *Hydrosus*.

(*d*) Antimonialis, arsenicalis; *e.g.*, Pulvis *Antimonialis* B.P., Vinum *Antimoniale* B.P., Liquor *Arsenicalis* B.P.

The U.S.P. has an adjective cantharidatus (cantharidial); *e.g.*, Collodium *Cantharidatum*.

iii. Geographical adjectives—

(*a*) Gallicus, Indicus, Peruvianus, Saigonicus, Socotrinus, Tolutanus, Zeylanicus; *e.g.*, Spiritus Vini *Gallici*, Cannabis *Indica*, Tinctura *Tolutana*, Syrupus *Tolutanus*.

(*b*) Barbadensis, Canadensis; *e.g.*, Aloe *Barbadensis* B.P., Terebinthina *Canadensis*.

iv. Adjectives indicating physical condition—

(*a*) Albus, flavus, niger, ruber, viridis; *e.g.*, Petrolatum *Album* U.S.P., Lotio Hydrargyri *Nigra* B.P.

(*b*) Durus, mitigatus (reduced in strength), ponderosus, fortis, levis, mollis; *e.g.*, Argenti Nitras *Mitigatus*, Magnesia *Ponderosa* B.P., Sapo *Mollis*.

(*c*) Amarus, aromaticus, deodoratus, dulcis, fetidus; *e.g.*, Amygdala *Amara*, Spiritus Ammoniæ *Aromaticus*, Opium *Deodoratum* U.S.P.

(*d*) Adhæsivus, compositus, concentratus, contusus (bruised), decorticatus, depuratus (clarified), destillatus, dialysatus, dilutus, expressus, exsiccatus (dried), fluidus, fusus (fused), granulatus, induratus, liquefactus, liquidus, lotus (washed), præcipitatus, præparatus, purificatus, purus, rectificatus, redactus B.P. and reductus U.S.P. (reduced), siccatus (dried), siccus (dry), sublimatus; effervescens, flexilis, glacialis, recens (fresh) solubilis, volatilis; *e.g.*, Emplastrum *Ad-*

hæsivum U.S.P., Tinctura Cinchonæ *Composita*, Mel *Depuratum*, Ferri Sulphas *Exsiccatus*, Collodium *Flexile*, Phenol *Liquefactum* U.S.P., Creta *Præparata*, Ferrum *Redactum* B.P. (Ferrum *Reductum* U.S.P.), Oleum Sinapis *Volatile*.

v. Adjectives indicating pharmacological effect: Antidiphthericus, causticus, corrosivus, epispasticus (blistering), mitis (mild), vesicans (blistering); *e.g.*, Serum *Antidiphthericum* U.S.P., Liquor *Epispasticus* B.P., Collodium *Vesicans* B.P.

vi. Unclassified: Absolutus, hypodermicus, animalis; *e.g.*, Alcohol *Absolutum*, Injectio Morphinæ *Hypodermica* B.P., Sapo *Animalis* B.P.

The following abbreviations are used in the inscription:

Aa, (ana), *of each.*

Q.s. (quantum sufficit), *as much as is sufficient, a sufficient quantity.*

Sing. (singulorum), *of each.*

Words of the subscription.—The words used in the subscription are comparatively few in number. Except in rare instances it is unnecessary to give directions for the dispensing of the inscription, and consequently the subscription frequently consists of the words *misce*; *fiat mistura, pilula, pulvis, suppositorium*, etc. To these are added, if necessary, such phrases as *mitte tales pilulas sex, mitte uncias*

octo, divide in partes æquales quatuor, etc., and any special operations, such as the coating of pills, the dispensing of powders in capsules, etc., that may be required. Examples are given in the prescriptions throughout this work.

Besides the names of the different forms of medicines already given, the following words are used in the subscription :

Materials, etc.

Aluta, æ, f., *plaster skin, a soft white leather.*

Capsula, æ, f., *a capsule.*

Capsula amylacea, *a cachet.*[1]

— gelatina elastica, *a soft gelatin capsule.*

— — operculata, *a hard gelatin capsule.*

— — repleta, *a filled gelatin capsule sold commercially.*

Carbasus, i, f., *gauze* (neuter in plur.: carbasa, orum).

Carbasus carbolata, *carbolised gauze.*

Carbasus iodoformata, *iodoform gauze.*

Charta, æ, f., *a paper (sometimes applied to a powder wrapped in paper).*

Charta cerata, *waxed paper.*

Chartula, æ, f., *a small paper (also applied to a powder wrapped in paper).*

Chartula amylacea, *a wafer.*

Cistella, æ, f., *a small box.*

Cistella assula, *a chip box.*

Gluma, æ, f., *a husk. Applied to empty suppository capsules* (see page 214).

Gossypium, ii, n., *cotton* (*cotton-wool*).

Gossypium absorbens, *absorbent cotton-wool.*

[1] Oblatum, i, a cachet, is also used.

Laguncula, æ, f., *a bottle.*[1]
Linteum, ei, n., *linen.*
  Linteum carptum, *lint.*
Narthecium, ii, n., *a gallipot.*
Olla, æ, f., *a jar.*
  Olla alba, *a white pot.*
  — fictilis, *an earthenware jar.*
  — vitrea, *a glass jar.*
Ollicula, æ, f., *a little jar.*
Phiala, æ, f., *a bottle,*[1] *a vial.*
  Phiala obturata, *a stoppered bottle.*
  — fusca, *a brown-coloured bottle.*
  — stillaticia (or pro stillicidio utenda), *a dropping bottle.*
Pyxis, idis, f., *a pill box.*
  Pyxis chartacea, *a powder box.*
  — assula, *a chip box.*
Scatula, æ, f., *a cardboard box such as is used for powders.*
Sericum, i, n., *silk.*
  Sericum oleatum, *oiled silk.*
Sindon, onis, f., *cambric, muslin.*
Vas, vasis, n. (plur. vasa, orum), *a vessel or utensil.*

Verbs.—Since the verbs in the subscription almost always convey orders for things to be done, they usually occur in the second person singular imperative, active voice, or in the third person singular or plural present subjunctive, passive voice—*e.g.*, *misce accuratissime,* mix intimately; *signetur directione propria,* let it be labelled with a

[1] A bottle is variously translated; *ampulla, æ, lagena, æ,* are occasionally used, and in Germany *vitrum, i.* is employed.

proper direction ; *conspergantur pulvere innocente*, let them be dusted with an innocuous powder.

The verbs chiefly used are :

addĕre, *to add.*
adhibēre, *to apply.*
admovēre, *to apply.*
applicare, *to apply.*
augēre, *to increase.*
colare, *to strain.*
conspergĕre, *to sprinkle.*
dare, *to give.*
decantare, *to decant.*
dispensare, *to dispense.*
dividĕre, *to divide.*
exhibēre, *to administer.*
exprimĕre, *to press out.*
extendĕre, *to spread.*
extrahĕre, *to extract.*
fieri, *to be made.*
filtrare, *to filter.*
imminuĕre, *to diminish.*
imponĕre, *to apply.*
infundĕre, *to infuse.*
infusare, *to infuse.*
inhalare, *to inhale.*
injicĕre, *to inject.*
instillare, *to drop into.*
involvĕre, *to roll in, to coat.*
liquefacĕre, *to melt (dissolve).*
macerare, *to macerate.*
miscēre, *to mix.*
mittĕre, *to send.*
obducĕre, *to cover.*
odorare, *to perfume.*
parare, *to prepare.*
percolare, *to percolate.*
pingĕre, *to paint.*
pulverare, *to pulverise.*
renovare, *to repeat.*
repetĕre, *to repeat.*
saturare, *to saturate.*
siccare, *to dry.*
signare, *to label.*
solvĕre, *to dissolve.*
spissare, *to thicken.*
terĕre, *to rub.*
triturare, *to triturate.*

Phrases and Abbreviations

Ad gr. acid. (Ad gratam aciditatem), *to an agreeable acidity.*

Ad gr. gust. (Ad gratum gustum), *to an agreeable taste.*

Ad neutral. (Ad neutralizandum), *to neutralisation.*
Ad sat. (Ad saturandum), *to saturation.*
Ad usum ext. (Ad usum externum), *for external use.*
Agit. ante sum. (Agita ante sumendum), *shake before taking.*
Cito disp. (Cito dispensetur), *let it be dispensed quickly.*
Cont. rem. (Continuantur remedia), *let the medicines be renewed.*
Deaur. pil. (Deaurentur pilulæ), *let the pills be gilded.*
Deb. spiss. (Debitæ spissitudinis), *to a proper consistence.*
Det. in 2plo (Detur in duplo), *let twice the quantity be given.*
Dir. prop. or D.P. (Directione propria), *with proper directions.*
Div. in p. æq. (Dividatur in partes æquales), *let it be divided into equal parts.*
Ext. sup. alut. (extende supra alutam), *spread upon leather.*
Gut. pro aur. (Guttæ pro auribus), *drops for the ears.*
Gut. pro oc. (Guttæ pro oculis), *drops for the eyes.*
Guttat. (Guttatim), *drop by drop.*
In act. (stat.) efferv. (In actu (statu) effervescentiæ), *during effervescence.*
In ph. obt. serv. (In phiala obturata servandus, a, um), *keep in a stoppered bottle.*
Invol. gel. (Involve gelatina), *coat with gelatin.*
M. d. u. (More dicto utendus, a, um), *to be used as directed.*
M. t. d. vj (Mitte tales doses numero sex), *send six doses.*
Mod. dict. (Modo dicto), *as prescribed.*

Mod. pr. (Modo præscripto), *as prescribed.*
Mor. sol. (More solito), *in the usual manner.*
Ne rep. (Ne repetatur), *do not repeat.*
P. p. (Pro paupere), *for a pauper.*
P. p. a. (Phiala prius agitata), *the bottle having been previously shaken.*
Part. æq. (Partes æquales), *equal parts.*
Pro dose, *for a dose.*
Pro usu ext. (Pro usu externo), *for external use.*
Pulv. gros. (Pulvis grossus), *a coarse powder.*
Pulv. ten. (Pulvis tenuis), *a fine powder.*
Q. dx. (Quantitas duplex), *twice the quantity.*
Q. p. (Quantum placet), *as much as you please.*
Q. s. (Quantum sufficit), *as much as is sufficient.*
Red. in pulv. (Redigatur in pulverem), *let it be reduced to powder.*
Rep. (Repetatur, repetantur), *let it (them) be repeated.*
Rep. semel (Repetatur semel), *let it be repeated once only.*
S. A. (Secundum artem), *according to art.* (Usually introduced when the medicine needs something more than indiscriminate admixture in dispensing. Lege artis is also used.)
Sol. c. len. cal. (Solve cum leni calore), *dissolve with gentle heat.*
Ult. præscrip. (Ultimo præscriptus, a, um), *the last ordered.*
Ut dict. (Ut dictum), *as directed.*

The signature.—Although it is advisable to write the directions to the patient in English, abbreviated Latin is still largely employed by practitioners,

especially for the stereotyped directions which commonly occur in prescriptions. For these certain recognised abbreviations exist, the most important of which are—

A. c. (Ante cibum or cibos), *before food* (*or meals*).
Alt. hor. (Alternis horis), *every other hour.*
B. i. d. s. (Bis in die sumendus, a, um), *to be taken twice a day.*
C. m. s. (Cras mane sumendus, a, um), *to be taken to-morrow morning.*
C. n. (Cras nocte), *to-morrow night.*
Cap. quant. vult (Capiat quantum vult), *let the patient take as much as he will.*
Dieb. alt. (Diebus alternis), *every other day.*
Dieb. tert. (Diebus tertiis), *every third day.*
Donec alv. dejec. (Donec alvus dejecerit), *until the bowels have been opened.*
Donec dol. evanuer. (Donec dolor evanuerit), *until the pain has passed away.*
Donec dol. len. (Donec dolor leniatur), *until the pain is relieved.*
E. m. p. (Ex modo præscripto), *as directed.*
Feb. dur. (Febri duranti), *during the fever.*
H. s. s. (Hora somni sumendus, a, um), *to be taken at bedtime.*
Lat. dol. admov. (Lateri dolenti admoveatur), *let it be applied to the painful side.*
M. d. u. (More dicto utendus, a, um), *to be used as directed.*
M. et v. applic. (Mane et vespere applicandus, a, um), *to be applied morning and evening.*
N. m. s. (Nocte maneque sumendus, a um), *to be taken night and morning.*

Omn. bihor. (Omni bihorio), *every two-hours.*
Omn. hor. (Omni hora), *every hour.*
P. a. a. (Parti affectæ applicandus, a, um), *to be applied to the affected part.*
P. c. (Post cibum), *after food.*
P. r. n. (Pro re nata), *occasionally.*
Part. vic. (Partitis vicibus), *in divided doses.*
Post sing. sed. liq. (Post singulas sedes liquidas), *after every loose stool.*
Pro pot. sum. (Pro potu sumendus, a, um), *to be taken as a drink.*
4ta qq. hor. (Quarta quaque hora), *every fourth hour.*
S. o. s. (Si opus sit), *if there is need, if necessary.*
Stat. eff. (Statu effervescentiæ), *whilst effervescing.*
T. d. s. (Ter in die sumendus, a, um), *to be taken three times a day.*
3tia hor. sum. (Tertia quaque hora sumendus, a, um), *to be taken every third hour.*

II

ENGLISH-LATIN VOCABULARY

Abdomen, *abdomen, inis*, n.
Abdominal, *abdominalis, e.*
Abortion, *abortio, onis*, f.
About [near to], *circiter* (with acc.); [around] *circum* (with acc.). About an hour after food, *horam circiter post cibum.*
Above, *super* (with acc.); *supra* (with acc.).
Abscess, *abcessus, ūs*, m.
Absent, to be, *absum, abfui, abesse.* In the absence of fever, *febri absente; dum febris absit.*
Absolute, *absolutus, a, um.*
Absorbent, *absorbens, entis.*
Acacia, *acacia, æ*, f.
Acalypha, *acalypha, æ*, f.
Accelerate, to, *accelero, avi, atum, are.*
Accordance with, in, *secundum* (with acc.).
According as, *prout.*
Account of, on, *ob, propter* (with acc.).
Accurate, *accuratus, a, um; exactus, a, um.*
Accurately, *accurate.*
Accustomed, to be, *soleo, solitus sum, solēre.*
Acetanilide, *acetanilidum, i*, n.
Acetate, *acetas, atis*, m.
Acetic, *aceticus, a, um.*
Acetone, *acetonum, i*, n.
Acid (subs.), *acidum, i*, n.
Acid (adj.), *acidus, a, um.*
Acidity, *aciditas, atis*, f.; *acerbitas, atis;* also *acidum* (*acido infestante,* when troubled with acidity).
Aconite, *aconitum, i*, n.
Aconitine, *aconitina, æ*, f.
Acrid, *asper, era, erum.*
Across, *trans* (with acc.).
Act, *actus, ūs*, m.
in the act of effervescence, *in actu effervescentiæ*; in the act of lively effervescence, *impetu effervescentiæ.*

Act, to, *ago, egi, actum, agĕre.* (*Cf.* bowels.)

Acute [of pain], *acer, acris, acre.*

Add, to, *addo, didi, ditum, dĕre; adjicio, jeci, jectum, jicĕre.*

Adhatoda, *adhatoda, æ,* f.

Adhesive, *adhæsivus, a, um.*

Administer, to [medicine], *adhibeo, ui, itum, ēre.*

Advice, *consilium, ii,* n.

Affect, to, *affecto, avi, atum, are; afficio, feci, fectum, ficĕre.*

Affected, *affectus, a, um.*

to the affected side, *lateri affecto.*

After, *post* (with acc.).

Afternoon, *post meridiem.*

of the afternoon, *pomeridianus, a, um.*

Afterwards, *postea.*

Age, *ætas, atis,* f.

Agitate, to, *agito, avi, atum, are.*

Agreeable, *gratus, a, um.*

to an agreeable acidity, *ad gratam aciditatem.*

Agropyrum, *agropyrum, i,* n.

Aid, *ops, opis,* f.

by means of a camel-hair brush, *ope penicilli.*

Aid, to, *adjuvo, juvi, jutum, juvare.*

Air, *aer, aeris,* m.

Albumen, *albumen, inis,* n.

Alcohol, *alcohol, olis,* n. (See page 307.)

Alcoholic, *alcoholicus, a, um.*

Aldehyde, *aldehydum, i,* n.

Alkaline, *alkalinus, a, um.*

All, *omnis, e.*

Allay, to, *levo, avi, atum, are.*

Alleviate, to, *lenio, ivi* (*ii*), *itum, ire.*

until the pain is relieved, *donec dolor leniatur,* or *donec dolor levatus sit.*

Allow, to, *permitto, misi, missum, mittĕre.*

Allspice, *pimenta, æ,* f.

Almond, *amygdala, æ,* f.

Almost, *fere.*

Aloe, *aloe, es,* f. (See page 306.)

Aloin, *aloinum, i,* n.

Alstonia, *alstonia, æ,* f.

Alter, to, *muto, avi, atum, are.*

Alternate, *alternus, a, um.*

every other night, *alternis noctibus.*

Alternately, *invicem, vicissim.*

Alum, *alumen, inis,* n.

dried alum, *alumen exsiccatum.*

Aluminium, *aluminium, i*, n.; *aluminum, i*, n. (U.S.P.).
American, *Americanus, a, um.*
Ammonia, *ammonia, æ*, f.
Ammoniacum, *ammoniacum, i*, n.
Ammoniated, *ammoniatus, a, um.*
Ammonium, *ammonium, ii*, n.
Amyl, *amylis, is*, m. (See page 307.)
Amylic, *amylicus, a, um.*
Andrographis, *andrographis, idis*, m.
Animal (adj.), *animalis, e.*
Anise, *anisum, i*, n.
Ankle, *malleolus, i*, m.
Another, *alius, alia, aliud.*
Antidote, *antidotum, i*, n.
Antimonial, *antimonialis, e.*
Antimony, *antimonium, ii*, n.; *stibium, ii*, n.
Antipyrin, *antipyrinum, i*, n. (U.S.P.); *phenazonum, i*, n. (B.P.).
Antiseptic (subs.), *antisepticum, i*, n.
Antiseptic (adj.), *antisepticus, a, um.*
Aperient (adj.), *aperiens, entis; catharticus, a, um.*
Apomorphine, *apomorphina, æ*, f.
Apparatus, *apparatus, ūs*, m.
Application (to a part), *applicatio, onis*, f.
Apply, to (to put to), *applico, avi (ui), atum (itum), are; adhibeo, ui, itum, ēre.*
Aqueous, *aquosus, a, um.*
Areca, *areca, æ*, f.
 areca nut, *semen arecæ.*
Arm, *brachium, ii*, n.
Armpit, *axilla, æ*, f.
Arnica, *arnica, æ*, f.
Aroma, *odor, oris*, m.
Aromatic, *aromaticus, a, um.*
Around, *circa, circum* (with acc.).
Arrowroot, *maranta, æ*, f.
Arsenate, *arsenas, atis*, m.
Arsenic (the element), *arsenium, ii*, n. (B.P.); *arsenum, i*, n. (U.S.P.).
Arsenical, *arsenicalis, e.*
Arsenite, *arsenis, itis*, m.
Art, *ars, artis*, f.
 skilfully, *secundum artem.*
Artery, *arteria, æ*, f.
Artificial, *factitius, a, um.*
As often as, *quoties.*
Asafetida, *asafetida, æ*, f.
Aseptic, *asepticus, a, um.*
Asleep, *dormiens, entis; in somno.*

Astringent, *astringens, entis.*
At least, *saltem.*
Atropine, *atropina, æ,* f.
Attack, *accessio, onis,* f.; *impetus, ūs,* m.
an attack of pain, *accessio doloris.*
Attend, to, *attendo, di, tum, dĕre.*
Aural, *auricularius, a, um.*
Avoid, to, *vito, avi, atum, are.*
Awake, *insomnis, e.*
Azadirachta, *azadirachta, æ,* f.

Baby, *infans, antis,* m. and f.
Back, *dorsum, i,* n.; (lower part) *tergum, i,* n.
Bael, *bela, æ,* f.
Baldness, *alopecia, e,* f.; *calvitium, ii,* n.; *calvities, ei,* f.
Ball, *pila, æ,* f.
pads of absorbent cotton wool, *gossypii absorbentis pilæ.*
Balsam, *balsamum, i,* n.
Bandage, *ligamentum, i,* n.; *fascia, æ,* f.
a linen bandage, *fascia lintea.*
Barbados, *Barbadensis, e.*
Barberry, *berberis, idis,* f.
Bare, *nudus, a, um.*
Barium, *barium, ii,* n.
Bark, *cortex, icis,* m. (and f.).
Barley, *hordeum, i,* n.
barley meal, *farina hordei.*
barley water, *decoctum hordei.*
Bath, *balneum, i,* n.
a foot-bath, *pediluvium, ii,* n.
a hip-bath, *coxæluvium, ii,* n.
a slipper-bath, *semicupium, ii,* n.
a vapour-bath, *balneum vaporis.*
Bean, *faba, æ,* f.
Bear, to, *fero, tuli, latum, ferre.*
Bearberry, *uva ursi.*
Beard, *barba, æ,* f.
Beat, to (in a vessel), *tundo, tutudi, tusum, tundĕre.*
Beberine, *beberina, æ,* f.
Bed, *lectus, i,* m.
Bedtime, *hora somni, hora decubitus.*
Beef (adj.), *bovinus, a, um.*
beef tea, *jus bovinum, jusculum, i,* n.
Beer, *cerevisia, æ,* f.
Beeswax, *cera, æ,* f.
Before, *ante* (with acc.).
before food, *ante cibum.*
Behind (prep.), *pone* (with acc.).

Behind (adj.), *posterus, a, um.*
Belladonna, *belladonna, æ,* f.
Belly, *venter, tris,* m.; *ventriculus, i,* m.; *alvus, i,* f.
Below, *infra* (with acc.).
Benzene. See Benzol.
Benzin (petroleum), *benzinum, i,* n.
Benzoate, *benzoas, atis,* m.
Benzoated, *benzoatus, a, um.*
Benzoic, *benzoicus, a, um.*
Benzoin, *benzoinum, i,* n.
Benzol, *benzol, olis,* n.
Berberine, *berberina, æ,* f.
Berberis, *berberis, idis,* f.
Berry, *bacca, æ,* f.
Beside, *præter* (with acc.).
Besprinkle, to, *conspergo, spersi, spersum, spergĕre.*
Beta naphthol, *beta naphthol, ŏlis,* n. (See page 307.)
Between, *inter* (with acc.).
Biborate, *biboras, atis,* m.
Bicarbonate, *bicarbonas, atis,* m.
Bichromate, *bichromas, atis,* m.; *dichromas, atis,* m.
Bile, *fel, fellis,* n.; *bilis, is,* f.
ox bile, *fel bovinum* (B.P.); *fel bovis* (U.S.P.).
Bind, to, *astringo, strinxi, strictum, stringere.*
Birch, *betula, æ,* f.
Birth, *partus, ūs,* m.
Bismuth, *bismuthum, i,* n.
Bisulphide, *bisulphidum, i,* n.; *disulphidum, i,* n.
Bitartrate, *bitartras, atis,* m.
Bitter, *amarus, a, um.*
Bitterness, *amaritas, atis,* m.; *amarities, ei,* f.
Black, *niger, gra, grum.*
Blackberry, *rubus, i,* m.
Black haw, *viburnum, i,* n.
Bladder, the, *vesica, æ,* f.
Bleach, to, *dealbo, avi, atum, are.*
Bleeding (from a part), *hæmorrhagia, æ,* f.
to let blood, *sanguinem emittĕre.*
Blister (the blistering substance), *vesicatorium, ii,* n.; *emplastrum cantharidis; emp. lyttæ; emp. vesicatorium.*
Blister (the bleb), *vesicula, æ,* f.
Blister, to (raise a blister), *vesico, avi, atum, are.*
Blistering, *epispasticus, a, um; vesicans, antis; vesicatorius, a, um.*
Blistering beetle, *cantharis, idis,* f.; *mylabris, idis,* f.

Blood root, *sanguinaria, æ*, f.
Blotting-paper, *charta bibula*, f.
Blue, *cæruleus, a, um*.
Body, *corpus, oris*, n.
a dead body, *cadaver, cris*, n.
Boil, to (v.a.), *coquo, coxi, coctum, coquĕre*.
to boil down, *decoquĕre*.
Boil, to (v.n.), *bullio, ivi, itum, ire*.
Bolus, *bolus, i*, m.
Bone, *os, ossis*, n.
Borax, *borax, acis*, m.; *sodii biboras* vel *pyroboras*.
Boric, *boricus, a, um*.
Both, *ambo, æ*, o.
Both sides, on, *utrinque*.
Bottle, *phiala, æ*, f.; *laguncula, æ*, f.; *ampulla, æ*, f.; *lagena, æ*, f.; *vitrum, i*, n.
a stoppered bottle, *phiala obturata; vitrum epistomate*.
an amber-coloured bottle, *phiala fusca; vitrum fuscum*.
Bottom (the lowest part), *fundus, i*, m.
Bougie, *bacillum, i*, n.; *bougia, æ*, f.; *cereolus i*, m.
an aural bougie, *suppositorium auricularium; aurinarium, ii*, n.
a nasal bougie, *suppositorium nasale; buginarium, ii*, n.
Bound, *astrictus, a, um*.
Bowels, *alvus, i*, f. (sing. only); *intestina, orum* (n. plur.).
the bowels being confined, *alvo astricta*; the bowels being relaxed, *alvo laxata*; until the bowels shall have acted, *donec dejecerit alvus*.
Box, *pyxis, idis*, f.; *cistella, æ*, f.
chip box, *pyxis* (*cistella*) *assula*.
powder box, *pyxis chartacea; scatula, æ*, f.
Bran, *furfur, uris*, n.
Brandy, *spiritus vini Gallici*.
Bread, *panis, is*, m.
bread crumb, *mica panis*.
brown bread, *panis furfuraceus*.
white bread, *panis candidus*.
Breakfast, *jentaculum, i*, n.
Breast, *mamma, æ*, f. [chest, *pectus, oris*, n.].

Breath, *anhelitus, ūs*, m.; *halitus, ūs*, m.
Breathe, to, *spiro, avi, atum, are.*
Breathing, *respiratio, onis*, f.
Briefly, *breviter.*
Brine, *muria, æ*, f.
British, *Britannicus, a, um.*
Broad, *latus, a, um.*
Bromide, *bromidum, i*, n.
Bromine, *bromum, i*, n.
Bromoform, *bromoformum, i*, n.
Broom (the plant), *scoparius, ii*, m.
  broom tops, *scoparii cacumina.*
Broth, *jus, juris*, n.; *jusculum, i*, n.
  beef tea, *jus bovinum.*
  chicken broth, *jus gallinaceum.*
  gruel, *jusculum avenaceum.*
  mutton broth, *jus ovillum.*
Brown, *fuscus, a, um.*
Bruise, *contusio, onis*, f.
Bruise, to, *contundo, tudi, tusum, tundĕre.*
Brush (camel hair), *penicillum, i*, n.
Buchu, *buchu*, indeclin.
Buckthorn *frangula, æ*, f.
Bulk, *magnitudo, inis*, f.
Burgundy (adj.), *Burgundicus, a, um.*
Burn, a, *ustio, onis*, f.
Burn, to, *uro, ussi, ustum, urĕre.*
Burnt, *ustus, a, um.*
Butea, *butea, æ*, f.
Butter, *butyrum, i*, n.
Butyl-chloral, *butyl chloral, alis*, n.
  (Also indeclin. See page 307.)
By means of, *ope.*

Cacao butter, *oleum theobromatis.*
Cachet, *capsula amylacea; oblatum, i*, n.
Cade, oil of, *oleum cadinum.*
Cadmium, *cadmium, i*, n.
Caffeine, *caffeina, æ*, f.
Cajuput, *cajuputi*, n. indeclin.
Calabar bean, *physostigma, atis*, n.
Calamine, *calamina, æ*, f.
Calamus, *calamus, i*, m.
Calcined, *ustus, a, um.*
Calcium, *calcium, ii*, n.
Calomel, *hydrargyri subchloridum* (B.P.); *hydrargyri chloridum mite* (U.S.P.); *calomelas, anos*, m.

Calotropis, *calotropis, is*, f.
Calumba, *calumba, æ*, f.
Cambric, *sindon, onis*, f.
Camel-hair brush, *penicillum, i*, n.
Camphor, *camphora, æ*, f.
Camphorated, *camphoratus, a, um.*
Camphoric, *camphoricus, a, um.*
Canadian, *Canadensis, e.*
Canella, *canella, æ*, f.
Cantharides, *cantharis, idis*, f.
Cantharidin, *cantharidinum, i*, n.
Caoutchouc, *caoutchouc*, n. indeclin. (B.P.); *elastica, æ*, f. (U.S.P.).
Capacity, *amplitudo, inis*, f.
Cape (adj.), *Capensis, e.*
Capsicum, *capsicum, i*, n.
Capsule, *capsula, æ*, f.; *gluma, æ*, f. (See page 214.)
a hard gelatin capsule, *capsula gelatina operculata.*
a soft gelatin capsule, *capsula gelatina elastica.*
Caraway fruit, *fructus carui.*
Carbamate, *carbamas, atis*, m.
Carbolated, *carbolatus, a, um.*
Carbolic acid, *acidum carbolicum; phenol, olis*, n.
Carbon (subs.), *carbo, onis*, m.
Carbon (adj.), *carboneus, a, um.*
Carbonate, *carbonas, atis*, m.
Cardamom, *cardamomum, i*, n.
Cardiac, *cardiacus, a, um.*
Carefully, *accurate, caute.*
Carminative (subs.), *carminativum, i*, n.
Carmine, *carminum, i*, n.
Cascara, *cascara, æ*, f.
Cascarilla, *cascarilla, æ*, f.
Cassia, *cassia, æ*, f.
Castile soap, *sapo durus.*
Castor (obtained from beaver), *castoreum, ci*, n.
Castor oil, *oleum ricini.*
Catechu, *catechu*, n. indeclin.
Cathartic (adj.), *catharticus, a, um.*
Caustic (subs.), *causticum, i*, n.
Caustic (adj.), *causticus, a, um.*
Cautiously, *caute.*
Cayenne pepper, *capsicum, i*, n.
Cease, to, *cesso, avi, atum, are.*
until the pain has ceased, *donec dolor cessaverit.*

Cerate, *ceratum, i,* n.
Cerium, *cerium, ii,* n.
Chalk, *creta, æ,* f.
Chalybeate (adj.), *chalybeatus, a, um.*
Chamomile, *anthemis, idis,* f.
Change, to, *muto, avi, atum, are.*
Charcoal, *carbo, onis,* m.
 animal charcoal, *carbo animalis.*
 wood charcoal, *carbo ligni.*
Cheek, *bucca, æ,* f.
Cheese, *caseus, i.* m.
Cherry (subs.), *cerasum, i,* n.
 wild cherry, *prunus virginiana.*
Cherry-laurel (subs.), *laurocerasus, i,* f.
Chest, *pectus, oris,* n.; *thorax, acis,* m.
 belonging to the chest, *pectoralis, e.*
Chicken, *gallina, æ,* f.
 chicken broth, *jus gallinaceum.*
Child, *infans, antis,* m. or f.
Chin, *mentum, i,* n.
Chiretta, *chirata, æ,* f.
Chloral (subs.), *chloralum, i,* n. (U.S.P.); *chloral, alis,* n.; *chloral,* n. indeclin. (B.P.).
Chloralamide, *chloralamidum, i,* n.
Chlorate, *chloras, atis,* m.
Chloride, *chloridum, i,* n.
Chlorinated, *chlorinatus, a, um.*
Chlorine, *chlorum, i,* n.
Chloroform, *chloroformum, i,* n.
Chocolate, *chocolata, æ,* f.
Choose, to, *deligo, delegi, delectum, deligĕre.*
Chromate, *chromas, atis,* m.
Chromic, *chromicus, a, um.*
Chromium, *chromium, ii,* n.
Chrysarobin, *chrysarobinum, i,* n.
Chrysophanic, *chrysophanicus, a, um.*
Cimicifuga, *cimicifuga, æ,* f.
Cinchona, *cinchona, æ,* f.
Cinchonidine, *cinchonidina, æ,* f.
Cinchonine, *cinchonina, æ,* f.
Cinnamic, *cinnamicus, a, um.*
Cinnamic aldehyde, *cinnaldehydum, i,* n.
Cinnamon, *cinnamomum, i,* n.
Cissampelos, *cissampelos, i,* f.
Citrate, *citras, atis,* m.
Citrated, *citratus, a, um.*
Citric, *citricus, a, um.*
Clarified, *depuratus, a, um.*

Clay (made of), *fictilis, e.*
earthenware jar, *olla fictilis.*
Clear, *clarus, a, um.*
Cloth (subs.), *pannus, i,* m.
cotton cloth, *pannus gossypinus.*
linen cloth, *pannus linteus.*
silk cloth, *pannus sericus.*
woollen cloth, *pannus laneus.*
Clothes, *vestimenta, orum,* n.
Clove, *caryophyllum, i,* n.; *caryophyllus, i,* m. (U.S.P.).
Clyster, *enema, atis,* n.
Coal-tar, *pix carbonis.*
Coarse (in size), *crassus, a, um.*
Coated, *tunicatus, a, um.*
coated pills, *pilulæ tunicatæ* (commonly applied to varnished pills).
Coca, *coca, æ,* f.
Cocaine, *cocaina, æ,* f.
Cochineal, *coccus, i,* m.
Cocoa, *cacao, onis,* m.
Cod (subs.), *morrhua, æ,* f.
cod-liver oil, *oleum morrhuæ.*
Codeine, *codeina, æ,* f.
Coffee, *coffea, æ,* f.
Colchicine, *colchicina, æ,* f.
Colchicum, *colchicum, i,* n.
Cold (subs.), *frigus, oris,* n.
cold cream, *unguentum aquæ rosæ.*
Cold (adj.), *frigidus, a, um.*
Collect, to (v.a.), *colligo, legi, lectum, ligĕre.*
Collodion, *collodium, ii,* n.
Colocynth, *colocynthis, idis,* f.
Colophony, *resina, æ,* f.
Colour, *color, oris,* m.
Colour, to, *coloro, avi, atum, are.*
Coloured, *coloratus, a, um.*
Colourless, *sine colore.*
Come on (attack), to (v.n.), *invado, vasi, vasum, vadĕre.*
Commence, to, *ineo, inivi, (inii), initum, inire.*
Commercial (adj.), *venalis, e.*
Common (adj.), *communis, e.*
Compound (adj.), *compositus, a, um.*
Compressed, *compressus, a, um.*
Concentrated, *concentratus, a, um.*
Condition, *status, ūs,* m.
Confection, *confectio, onis,* f.; *conserva, æ,* f.; *electuarium, ii,* n.
Confined, *adstrictus, a, um.*
the bowels being confined, *alvo adstricta.*
Coniine, *conina, æ,* f.

Consistence, *densitas, atis,* f.; *spissitudo, inis,* f.
to a pilular consistence, *ad massæ pilularum densitatum.*
to a suitable consistence, *ad spissitudinem idoneam.*
Constantly, *frequenter.*
Constipation, *constipatio, onis,* f.
Continue, to, *persisto, stiti,* no sup., *sistĕre.*
let the patient continue with the mixture, *persistat in usu misturæ.*
Continuously, *continuo.*
Convallaria, *convallaria, æ,* f.
Convulsion, *convulsio, onis,* f.
Cook, to, *coquo, coxi, coctum, coquĕre.*
Cool, to, *refrigero, avi, atum, are.*
Cool, *frigidus, a, um.*
Copaiba, *copaiba, æ,* f.
Copious, *plenus, a, um.*
Copper, *cuprum, i,* n.
Copy (of a prescription), *exemplum, i,* n.
Cordial (subs.), *cordiale, is,* n.
Coriander, *coriandrum, i,* n.
Cork (adj.), *suberinus, a, um.*
Corm, *cormus, i,* m.
Corn, *frumentum, i,* n.
Corn (a tumour), *clavus, i,* m.
Corn silk (the plant), *zea, æ,* f.
Correct, to, *corrigo, rexi, rectum, rigĕre.*
Coscinium, *coscinium, i,* n.
Costive, *astrictus, a, um.*
Cotton, *gossypium, ii,* n.
absorbent cotton wool, *g. absorbens.*
Couch-grass, *agropyrum, i,* n. (B.P.); *triticum, i,* n. (U.S.P.).
Cough, *tussis, is,* f. (acc. *tussim*).
Court-plaster, *sericum anglicum.*
Cover over, to, *protego, texi, tectum, tegĕre.*
Covered, *opertus, a, um.*
Covering, *tegmen, inis,* n.
Cream, *cremor, oris,* m.
Creosote, *creosotum, i,* n.
Cresol, *cresol, olis,* n.
Croton, *croton, onis,* n.
croton oil, *oleum crotonis.*
Crude, *crudus, a, um.*
Crumb, *mica, æ,* f.
bread crumb, *mica panis.*
Crystalline, *crystallinus, a, um.*
Cubebs, *cubeba, æ,* f.
Cucumber, *cucumis, eris,* m.
squirting cucumber, *ecballium, ii,* n.

Cucurbita, *cucurbita, æ*, f.
Cup, *poculum, i*, n.
a small cup, *pocillum, i*, n.
Curd soap, *sapo animalis.*
Cure, to, *curo, avi, atum, are.*
Currant, *ribes, is*, n.
black currant, *ribes nigrum.*
currants, *uvæ Corinthæ.*
Cusparia, *cusparia, æ*, f.
Cut, to, *incido, cidi, cisum, cidĕre.*
Cut apart, to, *scindo, scidi, scissum, scindĕre.*
Cyanide, *cyanidum, i*, n.
Cypripedium, *cypripedium, ii*, n.

Daily (adj.), *diurnus, a, um.*
Daily (adv.), *quotidie.*
Dandelion, *taraxacum, i*, n.
Datura, *datura, æ*, f.
Day, *dies, ei*, m. and f.
to-day, *hodie.*
from day to day, *in dies.*
on alternate days, *diebus alternis.*
a period of two or three days, *biduum, triduum, ui*, n.
on the day after, *postridie.*
Decoction, *decoctum, i*, n.
Decolorise, to, *decoloro, avi, atum, are.*
Deliquesce, to, *deliquesco, licui, liquescĕre.*
Density, *densitas, atis*, f.
Deodorised, *deodoratus, a, um.*
Deposit, *sedimentum, i*, n.
Desiccated, *siccus, a, um.*
Detannated, *detannatus, a, um.*
Dialysed, *dialysatus, a, um.*
Diaphoretic, *diaphoreticum, i*, n.
Dichromate, *dichromas, atis*, m.
Diet (food, etc.), *diæta, æ*, f.
Difficult, *difficilis, e.*
Digest, to, *digero, gessi, gestum, gerĕre.*
Digestion, *digestio, onis*, f.
Digitalin, *digitalinum, i*, n.
Digitalis, *digitalis, is*, f.
Dill, *anethum, i*, n.
Dilute, to, *diluo, lui, lutum, luĕre.*
Diluted, *dilutus, a, um.*
Diminish, to, *imminuo, ui, utum, uĕre.*
Dinner, *prandium, ii*, n.
Direct, to, *dirigo, rexi, rectum, rigĕre; dico, dixi, dictum, dicĕre.*
as directed, *more dicto.*
Disappear, to, *evanesco, evanui, evanescĕre.*
Discs, *lamellæ, arum*, f.
Disease, *morbus, i*, m.

Diseased, *morbidus, a, um*
Dispense, to, *dispenso, avi, atum, are.*
Dispensing, *dispensatio, onis*, f.
Dissolve, to, *solvo, solvi, solutum, solvĕre.*
Distil, to, *destillo, avi, atum, are.*
Distilled, *destillatus, a, um.*
Divide, to, *divido, visi, visum, vidĕre; partior, partitus sum, partiri.*
Division, *partitio, onis*, f.
Dose, *dosis, is*, f. (acc. *dosin*).
in divided doses, *dosibus partitis* (vel *divisis* vel *dividuis*).
Double (subs.), *duplum, i*, n.
Double (adj.), *duplex, icis.*
Drachm, *drachma, æ*, f.
Draught, *haustus, ūs*, m.
Dried, *exsiccatus, a, um.*
Drink (subs.), *potus, ūs*, m.
Drop, *gutta, æ*, f.
Drop into, to, *instillo, avi, atum, are.*
dropping (subs.), *stillicidium, ii*, n.
dropping (adj.), *stillaticius, a, um.*
Drug, *medicamentum, i*, n.
Dry, *siccus, a, um.*
Dry, to, *sicco, avi, atum, are.*
Dusting powder, *pulvis conspersus.*

Each (adj.), *singulus a, um* (always used in plural).
with each dose, *cum dosi quaque.*
Each (pron. indef.), *quisque, quæque, quidque* (*quodque*).
every (each) fourth hour, *quarta quaque hora.*
Each ingredient, of, *ana, aa.*
Ear, *auris, is*, f.
Early (in the morning), *matutinus, a, um.*
Early (adv.), *primo.*
Earthenware (adj.), *fictilis, e.*
earthenware jar, *olla fictilis.*
Effervescence, *effervescentia, æ*, f.
in the act of effervescence, *in actu* (*statu*) *effervescentiæ.*
Effervescing, *effervescens, entis.*
Egg, *ovum, i*, n.
white of egg, *ovi albumen.*
yolk of egg, *ovi vitellus.*
Elaterin, *elaterinum, i*, n.
Elaterium, *elaterium, ii*, n.

Elbow, *cubitum, i*, n.
Elemi, *elemi*, n. indeclin.
Elixir, *elixir, is*, n. (plur. *elixiria*).
Elm, *ulmus, i*, f.
Embelia, *embelia, æ*, f.
Embrocation, *embrocatio, onis*, f.
Emetic, an, *emeticum, i*, n.; *emetica, æ*, f.
Employ, to, *adhibeo, ui, itum, ēre.*
Empty (adj.), *vacuus, a, um.*
Emulsion, *emulsio, onis*, f.; *emulsum, i*, n. (U.S.P.).
Enema, *enema, atis*, n.
English (adj.), *Anglicus, a, um.*
Enough, *satis.*
Envelop, to, *involvo, volvi, volutum, volvĕre.*
Equal, *æqualis, e; par, paris.*
  with an equal quantity of water, *cum tantadem aqua.*
Ergot, *ergota, æ*, f.
Ergotin, *ergotinum, i*, n.
Erigeron, *erigeron, tis*, n.
Eriodictyon, *eriodictyon, i*, n. (See page 306).
Eruption, *eruptio, onis*, f.
Eserine, *physostigmina, æ*, f.
Essence, *essentia, æ*, f.
Ether, *æther (ether), eris*, m.
Ethereal, *æthereus, a, um.*
Ethyl (subs.), *æthylis, is*, m.; *ethyl*, n. indeclin. (*Cf.* page 307.)
Ethylate, *ethylas, atis*, m.
Ethylic, *ethylicus, a, um.*
Eucalyptol, *eucalyptol, olis*, n.
Eucalyptus, *eucalyptus, i*, m.
Eugenol, *eugenol, olis*, n.
Euonymus, *euonymus, i*, m.
Eupatorium, *eupatorium, ii*, n.
Euphorbium, *euphorbium, ii*, n.
Evacuation, *evacuatio, onis*, f.
Evaporate, to, *evaporo, avi, atum, are.*
Evening, *vesper, eris*, m.
Every, *omnis, e.* See Each.
  every three hours, *tertia quaque hora.*
Excite, to, *excito, avi, atum, are.*
Exhibit, to, *exhibeo, ui, itum, ēre.*
Expectoration, *expuitio, onis*, f.; *sputum, i*, n.
Expel, to, *exigo, egi, actum, igĕre.*
Extend, to, *extendo, di, sum (tum), tendĕre.*
External, *externus, a, um.*
  for external use, *pro usu externo.*

Extract, *extractum, i*, n.
Extract, to, *extraho, traxi, tractum, trahĕre*.
Eye, *oculus, i*, m.
Eyebrow, *supercilium, ii*, n.
Eyelid, *palpebra, æ*, f.
Eye-lotion, *collyrium, ii*, n.

Face, *facies, ei*, f.
Fainting, *deliquium, ii*, n.; *defectio animi*.
Faintness, *languor, oris*, m.
False, *falsus, a, um*.
Fasting (subs.), *jejunium, ii.*, n.
Fasting (adj.) *jejunus, a, um*.
on an empty stomach, *ventriculo jejuno*.
Fat (subs.), *adeps, adipis*, m.
Feed, to, *nutrio, ivi (ii), itum, ire*.
Female, *femina, æ*, f.
Fennel, *fœniculum, i*, n.
Fern, *filix, icis*, f.
male fern, *filix mas* (B.P.); *aspidium, ii*, n. (U.S.P.)
Ferricyanide, *ferricyanidum, i*, n.
Ferrocyanide, *ferrocyanidum, i*, n.
Fetid, *fetidus, a, um*.
Fever, *febris, is*, f.
Fig, *ficus, ūs*, f.
Fill, to, *compleo, evi, etum, ēre*.
Filter, to, *filtro, avi, atum, are*.
Fine (minute), *subtilis, e*; (slender) *tenuis, e*.
Finger, *digitus, i*, m.
Finish, to, *finio, ivi (ii), itum, ire*.
Fit (convulsion), *convulsio, onis*, f.; *impetus, ūs*, m.
Fit (suitable), *idoneus, a, um*.
Flannel, *lanula, æ*, f.
Flask, *ampulla, æ*, f.
Flat, *planus, a, um*.
Flatulence, *flatus, ūs*, m.; *inflatio, onis*, f.
Flavour, *sapor, oris*, m.
Flavour, to, *condio, ivi (ii), itum, ire*.
Flexible, *flexilis, e*.
Flour, *farina, æ*, f.
Flow, to, *fluo, fluxi, fluxum, fluĕre*.
Flower, *flos, floris*, m.
Fluid (subs.), *liquor, oris*, m.
Fluid (adj.), *fluidus, a, um*; also used in combination, as *fluidrachma, fluidextractum, fluiduncia*.
Fold, to, *involvo, volvi, volutum, volvĕre*; *plico, avi, atum, are*.
Follow, to, *sequor, secutus sum, sequi*.

Following, *sequens, entis.*
  on the following day, *die sequente.*
Foment, to, *foveo, fovi, fotum, fovēre.*
Fomentation, *fomentum, i*, n.
Food, *cibus, i*, m.
  after food, *post cibum.*
  before food, *ante cibum.*
  between meals, *inter cibos.*
Foot, *pes, pedis*, m.
Foot-bath, *pediluvium, ii*, n.
Forehead, *frons, frontis*, f.
Foreign, *exoticus, a, um.*
Form (shape), *forma, æ*, f.
Formaldehyde, *formaldehydum, i*, n.
Formerly, *olim.*
Foxglove, *digitalis, is*, f.
Fracture, *fractura, æ*, f.
Frankincense, *thus, thuris*, n.
Freely, *plene.*
  freely diluted, *plene dilutus, a, um.*
French (adj.), *Gallicus, a, um.*
Frequent, *frequens, entis.*
Frequently, *frequenter.*
Fresh, *recens, entis.*
Friction, *frictio, onis*, f.
Fruit, *fructus, ūs*, m.
Full, *amplus, a, um; plenus, a, um.*

Fumigate, to, *fumigo, avi, atum, are.*
Fuming, *fumans, antis.*
Funnel, *infundibulum, i*, n.
Fused, *fusus, a, um; deflagratus, a, um.*

Galbanum, *galbanum, i*, n.
Gall (bile), *fel, fellis*, n.
  ox gall, *fel bovinum.*
Gall (botan.), *galla, æ*, f.
Gallic, *gallicus, a, um.*
Gallon, *congius, ii*, m.
Gambir, *gambir*, n. indeclin.
Gamboge, *cambogia, æ*, f.
Gargle, *gargarisma, atis*, n.
Garlic, *allium, ii*, n.
Gas, *gas, gasis*, n.; *vapor, oris*, m.
  until the evolution of gas has ceased, *donec evolutio gasis cessaverit.*
Gaultheria, *gaultheria, æ*, f.
Gauze, *carbasus, i*, f.
  carbolic gauze, *carbasus carbolata.*
Gelatin, *gelatinum, i*, n.
Gelsemium, *gelsemium, ii*, n.
Gentian, *gentiana, æ*, f.
Gentle, *lenis, c.*
  with gentle heat, *leni calore.*
Genuine, *verus, a, um.*
German (adj.), *Germanicus, a, um.*

Giddiness, *vertigo, inis*, f.
Gild, to, *deauro, avi, atum, are*.
let the pills be gilded, *deaurentur pilulæ*.
Ginger, *zingiber, cris*, n.
Give, to, *do, dedi, datum, dare*.
Glacial, *glacialis, e*.
Gland, *glandula, æ*, f.
Glass, *vitrum, i*, n.
made of glass (adj.) *vitreus, a, um*.
a glass capsule, *capsula vitrea*.
Glassful, *cyathus, i*, m.
wineglassful, *cyathus vinarius* vel *vinosus*.
Globule, *globulus, i*, m.
Glonoin. See Nitroglycerin.
Glucose, *glucosum, i*, n.
Gluside, *glusidum, i*, n. (B.P.) ; *benzosulphinidum, i*, n. (U.S.P.).
Glycerin, *glycerinum, i*, n.
Glycerinated, *glycerinatus, a, um*.
glycerinated gelatin, *gelatinum glycerinatum*.
Glycerite, *glyceritum, i*, n.
Glycyrrhizin, *glycyrrhizinum, i*, n.
Goa powder, *araroba, æ*, f.
Gold, *aurum, i*, n.
Golden, *auratus, a, um ; aureus, a, um*.
Golden seal, *hydrastis, is*, f.
Gradual, *lenis, e*.
Gradually, *gradatim, paullatim, pedetentim, sensim*.
Graduated bottle, *phiala dosi notata ; phiala notata gradatione*.
Grain (weight), *granum, i*, n.
Grain (corn), *frumentum, i*, n.
Gramme, *gramma, atis*, n.
Granulated, *granulatus, a, um*.
Granule, *granulum, i*, n.
Grape, *uva, æ*, f.
Great, *magnus, a, um*.
Green, *viridis, e*.
Grey, *cinereus, a, um*.
Grind, to, *tero, trivi, tritum, terĕre*.
Grindelia, *grindelia, æ*, f.
Groin, *inguen, inis*, n.
Gruel, *pulmentum, i*, n.
Guaiacol, *guaiacol, olis*, n.
Guaiacum, *guaiacum, i*, n.
Guarana, *guarana, æ*, f.
Gum, *gummi*, n. indeclin.
Gum (anat.), *gingiva, æ*, f.
Gummy, *gummosus, a, um*.
Gun-cotton, *pyroxylinum, i*, n.
Gutta-percha, *gutta percha*, n. indeclin.

Hæmatoxylon, *hæmatoxylon, i,* n.
Hair (subs.), *capillus, i,* m.; *crinis, is,* m.
Hair (adj.), *crinalis, e.*
Half [1] (subs.), *dimidium, ii,* n.; *semis, issis,* m.
a drachm and a half, *drachma cum semisse.*
Half [1] (adj.) *dimidius, a, um; semi* as a prefix.
Hamamelis, *hamamelis, idis,* f.
Hand, *manus, ūs,* f.
Hard, *durus, a, um.*
Harden, to, *duro, avi, atum, are; induro, avi, atum, are.*
Harmless, *innocuus, a, um.*
Hasten, to, *accelero, avi, atum, are.*
Head, *caput, itis,* n.
Headache, *cephalalgia, æ,* f.
Heal, to, *curo, avi, atum, are.*
Healthy, *sanus, a, um.*
Heart, *cor, cordis,* n.
Heat, *calor, oris,* m.
with gentle heat, *leni calore.*
Heat (make warm), to, *calefacio, feci, factum, facĕre.*
Heavy, *ponderosus, a, um.*
Hectogramme, *hectogramma, atis,* n.
Heel, the, *calx, calcis,* f.
Hellebore, *helleborus, i,* m.; *veratrum, i,* n.
Hemidesmus, *hemidesmus, i,* m.
Hemlock, *conium, ii,* n.
Hemp, *cannabis, is,* f.
Canadian hemp, *apocynum, i,* n.
Hen, *gallina, æ,* f.
Henbane, *hyoscyamus, i,* m.

[1] In Latin prescriptions 'half' is expressed (i.) by the substantive *dimidium, ii* (unciæ dimidium); (ii.) by the adjective *dimidius, a, um,* in conjunction with *pars* (drachmæ pars dimidia); (iii.) by the substantive *semis, issis* (m.), which is always used in the ablative case with *cum* and after an integer (unciæ duæ cum semisse); (iv.) in a few cases by the prefix *semi-* or *sem-* (semidrachma, semuncia).

Other fractions are expressed by employing a cardinal number for the numerator (*unus* is not expressed) and an ordinal number for the denominator, in conjunction with *pars*—*e.g.*, tres quartæ partes grani, or after *recipe*, as in a prescription, tres quartas partes grani. [The substantive *quadrans, antis* (m.), is also employed to express a fourth—*e.g.*, tres quadrantes grani.]

Herb, *herba, æ*, f.
Hexamethylenetetramine, *hexamethylenamina, æ*, f. (U.S.P.).
Hip, *coxa, æ*, f.
hip-bath, *coxæluvium, ii*, n.
Hog, *sus, suis*, m. and f.; *porcus, i*, m.
Hollow (adj.), *cavus, a, um.*
Homatropine, *homatropina, æ*, f.
Honey, *mel, mellis*, n.
Hop, *lupulus, i*, m.
Horehound, *marrubium, ii*, n.
Horse-radish, *armoracia, æ*, f.
Hot, *calidus, a, um; fervidus, a, um.*
Hour, *hora, æ*, f.
Hydrastine, *hydrastina, æ*, f.
Hydrastinine, *hydrastinina, æ*, f.
Hydrastis, *hydrastis, is*, f.
Hydrate, *hydras, atis*, m.
Hydrated, *hydratus, a, um.*
Hydriodic, *hydriodicus, a, um.*
Hydrobromic, *hydrobromicus, a, um.*
Hydrochloric, *hydrochloricus, a, um.*
Hydrochloride, *hydrochloridum, i*, n.
Hydrocyanic, *hydrocyanicus, a, um.*
Hydrogen, *hydrogenium, ii*, n.
Hydrous, *hydrosus, a, um.*
Hydroxide, *hydroxidum, i*, n.
Hyoscine, *hyoscina, æ*, f.
Hyoscyamine, *hyoscyamina, æ*, f.
Hypodermic, *hypodermicus, a, um.*
Hypophosphite, *hypophosphis, itis*, m.
Hypophosphorous, *hypophosphorosus, a, um.*
Hyposulphite, *hyposulphis, itis*, m.; *thiosulphas, atis*, m.

Ice, *glacies, ci*, f.
Iceland moss, *cetraria Islandica*, f.
Ichthyol, *ichthyol, olis*, n.
Ichthyolate, *ichthyolas, atis*, m.
Icy, *glacialis, e; frigidus, a, um.*
Ignite, to, *incendo, di, sum, dĕre.*
Immediately, *statim, protinus*, etc.
Immerse, to, *immergo, mersi, mersum, mergĕre.*

Inclose, to, *includo, si, sum, dĕre.*
inclosed, *inclusus, a, um.*
Increase, to, *augeo, auxi, auctum, augēre; cresco* (and *accresco*), *crevi, cretum, crescĕre.*
Indian (adj.), *Indicus, a, um.*
Infant, *infans, antis,* m. and f.
Infection, *contagio, onis,* f.
Inflamed, *inflammatus, a, um.*
Inflammation, *inflammatio, onis,* f.
Infuse, to, *infundo, fudi, fusum, fundĕre; infuso, avi, atum, are.*
Infusion, *infusum, i,* n.
Inhalation, *inhalatio, onis,* f.; *inspiratio, onis,* f.; *vapor, oris,* m.
fumes for inhalation, *fumi, orum,* m.
Inhale, to, *inhalo, avi, atum, are.*
Inject, to, *injicio, jeci, jectum, jicĕre.*
Injection, *injectio, onis,* f.
Inner, *internus, a, um.*
Inspissate, to, *spisso, avi, atum, are.*
Instantly, *statim, instanter.*
Instillation, *instillatio, onis,* f.
Insufflation, *insufflatio, onis,* f.
Intermediate, *medius, a, um.*
Internally, *intus.*
Interval, *intervallum, i,* n.
Intimately, *intime.*
mix intimately, *misce intime.*
Introduce, to, *introduco, duxi, ductum, ducĕre.*
Iodide, *iodidum, i,* n.
Iodine, *iodum, i,* n.
Iodoform, *iodoformum, i,* n.
Iodol, *iodolum, i,* n.
Ipecacuanha, *ipecacuanha, æ,* f.
Iron, *ferrum, i,* n.
Irrigation, *irrigatio, onis,* f.
Irritate, to, *irrito, avi, atum, are.*
Irritation, *irritatio, onis,* f.
Italian (adj.), *Italicus, a, um.*
Ivory, made of, *eburneus, a, um.*

Jaborandi, *jaborandi,* n. indeclin. (B.P.); *pilocarpus, i,* f. (U.S.P.).
Jalap, *jalapa, æ,* f.
Jam, a, *conserva, æ,* f.
Jar, *olla, æ,* f.
earthenware jar, *olla fictilis.*
Jaw, *mala, æ,* f.

Jelly, *gelatina, æ,* f.; *gelatum, i,* n.
calf's-foot jelly, *gelatina vitulina.*
Jelly, to, *gelo, avi, atum, are.*
Juice, *succus, i,* m.
Juniper, *juniperus, i,* f.

Kamala, *kamala, æ,* f.
Kaolin, *kaolinum, i,* n.
Keep, to, *conservo, avi, atum, are.*
Keratin, *keratinum, i,* n.
Kidneys, *renes, um,* m. (plur.).
Kilogramme, *kilogramma. atis,* n.
Kino, *kino,* n. indeclin.
Knee, *genu, ūs,* m.
Kousso, *cusso,* n. indeclin.

Label, *signatura, æ,* f.
Label, to, *signo, avi, atum, are.*
Lactic, *lacticus, a, um.*
Lactophosphate, *lactophosphas, atis,* m.
Lactose, *saccharum lactis.*
Lactucarium, *lactucarium, ii,* n.
Lamp-black, *fuligo, inis,* f.
Lanolin, *adeps lanæ hydrosus; lanolinum, i,* n.
Lard, *adeps, adipis,* m.

Large, *largus, a, um; magnus, a, um; ingens, entis.*
Larynx, *larnyx, ngis,* m.
Lately, *nuper.*
Laudanum, *tinctura opii; laudanum, i,* n.
Laurel, *laurus, i,* f.
cherry laurel, *laurocerasus, i,* f.
Lavender, *lavandula, æ,* f.
Laxative (adj.), *laxativus, a, um.*
Layer, *stratum, i,* n.
Lead, *plumbum, i,* n.
Leaf, *folium, ii,* n.
Leather (soft), *aluta, æ,* f.
upon leather, *super alutam.*
Leave out, to, *omitto, misi, missum, mittĕre.*
Leech, *hirudo, inis,* f.; *sanguisuga, æ,* f.
to apply leeches, *hirudines imponere.*
Left (remaining), *reliquus, a, um.*
Left (opposed to right), *lævus, a, um; sinister, tra, trum.*
Leg, *crus, cruris,* n.
Lemon, *limon, onis,* f.
Length, *longitudo, inis,* f.
Leptandra, *leptandra, æ,* f.
Leptandrin, *leptandrinum, i,* n.

Lessen, to, *deminuo, ui, utum, uĕre.*
Lettuce, *lactuca, æ,* f.
Levigate, to, *levo, avi, atum, are.*
Lid (of a box), *operculum, i,* n.
Lie down, to, *cubo, ui, itum, are.*
Life, *vita, æ,* f.
Light (subs.), *lux, lucis,* f.
  early in the morning, *luce prima.*
Light (adj.), *lĕvis, e.*
Lily-of-the-valley, *convallaria, æ,* f.
Lime (calcium oxide), *calx, calcis,* f.
Lime (fruit), *limetta, æ,* f.
  lime juice, *succus limettæ.*
Linctus, *linctus, ūs,* m.
Linen (subs.), *linteum, ei,* n.
  linen cloth, *linteolum, i,* n.; *pannus linteus.*
Linen (adj.), *linteus, a, um.*
Liniment, *linimentum, i,* n.
Linseed, *linum, i,* n.
  crushed linseed, *linum contusum.*
  linseed meal, *farina lini.*
Lint, *linteum carptum.*
Lip, *labium, i,* n.
Liquefied, *liquefactus, a, um.*
Liquefy, to, *liquefacio, feci, factum, facĕre.*
Liquid (subs.), *liquidum, i,* n.
Liquid (adj.), *liquidus, a, um.*
Liquor, *liquor, oris,* m.
Liquorice, *glycyrrhiza, æ,* f.
Litharge, *plumbi oxidum; lithargyrum, i,* n.
Lithium, *lithium, ii,* n.
Little, a, *pauxillum, i,* n.; *paululum, i,* n.
  little-by-little, *paulatim.*
Liver, *hepar, atis,* n.; *jecur, oris,* n.
Lobelia, *lobelia, æ,* f.
Logwood, *hæmatoxylon, i,* n.
Loins, *lumbi, orum,* m. (plur.).
Long, *longus, a, um.*
Loose, to make, *laxo, avi, atum, are; solvo, solvi, solutum, solvĕre.*
Loosened, *laxatus, a, um.*
Lotion, *lotio, onis,* f.
  an eye lotion, *collyrium, ii,* n.
  a mouth wash, *collutorium, ii,* n.
Lozenge, *trochiscus, i,* n.
Lukewarm, *tepidus, a, um.*
Lung, *pulmo, onis,* m.
Lupulin, *lupulinum, i,* n.
Lycopodium, *lycopodium, ii,* n.

Mace, *macis, idis*, f.
Macerate, to, *macero, avi, atum, are.*
Maceration, *maceratio, onis*, f.
Made, to be, *fio, factus sum, fieri.*
let a mixture be made, *fiat mistura.*
Magnesia, *magnesia, æ*, f.
Magnesium, *magnesium, ii*, n.
Make, to, *facio, feci, factum, facĕre.*
Malt, *maltum, i*, n.; *byne, es*, f.
Manganese, *manganesium, ii*, n.
Manna, *manna, æ*, f.
Manner, *modus, i*, m.; *mos, moris*, m.
in the manner directed, *modo dicto; more dicto.*
in the usual manner, *more solito.*
Marble (subs.), *marmor, oris*, n.
Marble (adj.), *marmoreus, a, um.*
Marigold, *calendula, æ*, f.
Mark, to, *noto, avi, atum, are.*
Marked, *notatus, a, um.*
Marrow, *medulla, æ*, f.
red marrow of bones, *medulla rubra.*
Marshmallow, *althæa, æ*, f.
Mass (pill), *massa, æ*, f.
Mastic, *mastiche, es*, f.
Masticate, to, *manduco, avi, atum, are; mastico, avi, atum, are.*
Masticatory, *masticatorium, ii*, n.
Material, *materia, æ*, f.
Matico, *matico*, n. indeclin.
Matured, *maturus, a, um.*
Meal (a repast), *cibus, i*, m.
between meals, *inter cibos.*
Meal (flour), *farina, æ*, f.
Means of, by, *ope* (abl. of *ops*).
Measure, *mensura, æ*, f.
Meat, *caro, carnis*, f.
Medical, *medicus, a, um.*
Medicated, *medicatus, a, um.*
Medicinal, *medicinalis, e.*
Medicine, a, *medicamentum, i*, n.; *remedium, ii*, n.
Melt, to, *liquefacio, feci, factum, facĕre.*
Melted, *liquefactus, a, um; fusus, a, um.*
Membrane, *membrana, æ*, f.
Menstruum, *menstruum, ui*, n.
Menthol, *menthol, olis*, n. (*Cf.* page 307).
Mercury, *hydrargyrum, i*, n.

Metal, *metallum, i*, n.
Metallic, *metallicus, a, um.*
Meter (measure), *metrum, i*, n.
Methyl, *methylis, is*, n. (U.S.P.); *methyl*, n. indeclin. (See page 307.)
Methylated, *methylatus, a, um.*
methylated spirit, *spiritus vini methylatus.*
Methylene blue, *methylthioninæ hydrochloridum* (U.S.P.).
Methylic, *methylicus, a, um.*
Methylthionine, *methylthionina, æ*, f.
Mezereum, *mezereum, i*, n.
Mid-day, *meridies, ei*, m.
Middle, *medius, a, um.*
Midnight, *media nox.*
Mild, *mitis, e.*
Milk, *lac, lactis*, n.
to be given in milk, *in lacte exhibendus, a, um.*
Milky, *lacteus, a, um.*
Milligramme, *milligramma, atis*, n.
Millimeter, *millimetrum, i*, n.
Minim, *minimum, i*, n.
Mint, *mentha, æ*, f.
Minute (time), *minutum, i*, n.
Mistake, *error, oris*, m.
Mistake, to, *erro, avi, atum, are.*
Mitigate, to, *mitigo, avi, atum, are.*
Mitigated, *mitigatus, a, um.*
Mix, to, *misceo, miscui, mistum* (*mixtum*), *miscēre.*
Mixture, *mistura, æ*, f.
Mode, *modus, i*, m.
Moderate, *moderatus, a, um.*
Moist, *humidus, a, um.*
Moisten, to, *madefacio, feci, factum, facĕre.*
Moisture, *humor, oris*, m.
Month, *mensis, is*, m.
Morning, *aurora, æ*, f.; *matutinum, i*, n.; *mane*, n. indeclin.
early in the morning, *aurora prima; primo mane*, etc.
in the morning, *mane* (adverbially).
Morphine, *morphina, æ*, f.
Morrow, to-, *cras*, n. indeclin.
to-morrow morning, *cras mane.*
the day after to-morrow, *perendiè.*
pertaining to to-morrow *crastinus, a, um.*
Mortar, a, *mortarium, ii*, n.; *pila, æ*, f.

Moss, *cetraria, æ*, f.
  Iceland moss, *cetraria Islandica.*
  Irish moss, *chondrus, i*, m.
Motion (stool), *dejectio, onis*, f.; *fæces, fæcum*, f. plur.; *sedes, sedum*, f. plur.
  after each liquid motion, *post singulas dejectiones liquidas; post singulas sedes liquidas.*
Mould (apparatus), *modulus, i*, m.
Mouth, *os, oris*, n.
  mouth wash, *collutorium, ii*, n.
Much, so, *tantus, a, um.*
Much, too (adv.), *nimis.*
Mucilage, *mucilago, inis*, f.
Mulberry, *morum, i*, n.
Musk, *moschus, i*, m.
Muslin, *sindon, onis*, f.
Mustard, *sinapis, is*, f.
  mustard leaf, *charta sinapis.*
Mylabris, *mylabris, idis*, f.
Myrobalans, *myrobalanum, i*, n.
Myrrh, *myrrha, æ*, f.

Nail (of finger or toe), *unguis, is*, m.
Naphthalene, *naphthalenum, i*, n.
Naphthol, *naphthol, olis*, n.
Narceine, *narceina, æ*, f.
Narcotine, *narcotina, æ*, f.
Nasal, *nasalis, e.*
Nasal bougie, *buginarium, ii*, n.; *suppositorium nasale.*
Nasal douche, *collunarium, ii*, n.
Natural, *naturalis, e.*
Nausea, *nausea, æ*, f.
Near, *apud, juxta, prope* (with acc.).
Nearly, *fere.*
Necessity (need), *opus*, n. indeclin.
  if necessary, *si opus sit.*
Nettle, *urtica, æ*, f.
Neuralgia, *neuralgia, æ*, f.
Neutral, *neutralis, e.*
New, *novus, a, um.*
Next (adj.), *proximus, a, um.*
Next (adv.), *deinde.*
Night, *nox, noctis*, f.
  at night, *nocte.*
  night and morning, *nocte maneque.*
Nightly, *nocturnus, a, um.*
Nipples, *mamillæ, arum*, f.
Nitrate, *nitras, atis*, m.
Nitric, *nitricus, a, um.*
Nitrite, *nitris, itis*, m.
Nitroglycerin, *glycerylis nitras* (U.S.P.); *trinitrinum, i*, n. (B.P.); *glonoinum, i*, n.; *nitroglycerinum, i*, n.

Nitrous, *nitrosus, a, um.*
Noon (subs.), *meridies, ei,* m.
Noon (adj.), *meridianus, a, um.*
Nose, *nasus, i,* m.
Nostril, *naris, is,* f.
Note, to, *noto, avi, atum, are.*
Nourishing, *nutriens, entis.*
Number, *numerus, i,* m.
Number, to, *numero, avi, atum, are.*
Nut, *nux, nucis,* f.
Nutriment, *cibus, i,* m.; *nutrimentum, i,* n.

Oak, *quercus, ūs,* f.
Oats, *avena, æ,* f.
  oatmeal, *avenæ farina.*
Observe, to, *noto, avi, atum, are.*
Occasionally, *pro re nata; subinde.*
Odorous, *odoratus, a, um.*
Odour, *odor, oris,* m.
Official, *officialis, e.*
Often, *sæpe.*
  as often as, *quoties.*
Oil, *oleum, ei,* n.
Oiled silk, *sericum oleatum.*
Ointment, *unguentum, i,* n.
Old (adj.), *vetus, eris.*
  — years old, *annos — natus.*
Oleate, *oleas, atis,* m. (B.P.); *oleatum, i,* n. (U.S.P.).
Oleic, *oleicus, a, um.*
Oleo-resin, *oleo-resina, æ,* f.
Oleosaccharum, *oleosaccharum, i,* n.
Olive, *oliva, æ,* f.
Omit, to, *omitto, misi, missum, mittĕre.*
Once, *semel.*
  at once, *simul.*
Once more, *denuo; iterum.*
Onion, *cepa, æ,* f.
Only, *tantum; modo.*
Opaque, *opacus, a, um.*
Open (adj.), *apertus, a, um.*
Open, to, *aperio, ui, tum, ire.*
Opening, *apertura, æ,* f.; *foramen, inis,* n.
Ophthalmic, *ophthalmicus a, um.*
Opium, *opium, ii,* n.
Opposite, *adversus, a, um.*
Orange, *aurantium, ii,* n.
Ordinary, *communis, e.*
Osmic, *osmicus, a, um.*
Ounce, *uncia, æ,* f.
  half an ounce, *semuncia, æ,* f.; *uncia dimidia, unciæ dimidium, unciæ pars dimidia.* (Cf. page 337.)
Outside (subs.), *externum, i,* n.
Outside (adj.), *externus, a, um.*

Outside of, *extra* (with acc.).
Over, *super*, *supra* (with acc.).
Own (adj.), *proprius*, *a*, *um*.
Ox, *bos*, *bovis*, m.
pertaining to oxen, *bovinus*, *a*, *um*.
ox-gall, *fel bovinum* (B.P.); *fel bovis* (U.S.P.).
Oxalate, *oxalas*, *atis*, m.
Oxalic, *oxalicus*, *a*, *um*.
Oxide, *oxidum*, *i*, n.
Oxymel, *oxymel*, *mellis*, n.

Pad, *pila*, *æ*, f.
absorbent pads, *pilæ gossypii absorbentis*.
Pain, *dolor*, *oris*, m.
when the pain is severe, *dolore urgente*.
Painful, *dolens*, *entis*.
Paint, *pigmentum*, *i*, n.
Paint, to, *pingo*, *pinxi*, *pictum*, *pingĕre*.
Palatable, *jucundus*, *a*, *um*.
Pale, *pallidus*, *a*, *um*.
Palm (of hand), *palma*, *æ*, f.
Palmetto, saw, *sabal*, n. indeclin.
Pancreas, *pancreas*, *atis*, n.
pertaining to the pancreas, *pancreaticus*, *a*, *um*.
Pancreatin, *pancreatinum*, *i*, n.
Paper, *charta*, *æ*, f.
powder papers, *chartulæ*, *arum*, f. plur.
waxed paper, *charta cerata*.
Paraffin, *paraffinum*, *i*, n.
Paraldehyde, *paraldehydum*, *i*, n.
Pareira, *pareira*, *æ*, f.
Paroxysm, *paroxysmus*, *i*, m.
Part, *pars*, *partis*, f.
equal parts, *partes æquales*.
Paste, *pasta*, *æ*, f.
Pastil, *pastillus*, *i*, m.
Patient (male), *æger*, *ægri*, m.; (female) *ægra*, *ægræ*, f.
Pea, *pisum* *i*, n.
Pear, *pirum*, *i*, n.
Peel, *cortex*, *icis*, m. and f.
Peeled, *decorticatus*, *a*, *um*.
Pelletierine, *pelletierina*, *æ*, f.
Pellitory, *pyrethrum*, *i*, n.
Penetrate, to, *permano*, *avi*, *atum*, *are*.
Pennyroyal, *pulegium*, *ii*, n.
American pennyroyal, *hedeoma*, *æ*, f.
Pepper, *piper*, *eris*, n.
Peppermint, *mentha piperita* *æ*, f.
Pepsin, *pepsinum*, *i*, n.
Peptone, *peptonum*, *i*, n.

Peptonised, *peptonatus, a, um.*
Perchloride, *perchloridum, i,* n.
Percolate, to, *percolo, avi, atum, are.*
Permanganate, *permanganas, atis,* m.
Permit, to, *patior, passus sum, pati.*
Peroxide, *peroxidum, i,* n.
Persist, to, *persisto, stiti, stitum sistĕre.*
Perspiration, *sudor, oris,* m.
Perspire, to, *sudo, avi, atum, are.*
Peruvian, *Peruvianus, a, um.*
Pessary, *pessus, i,* n.; *suppositorium vaginale.*
Petal, *petalum, i,* n.
Petrolatum, *petrolatum, i,* n.
Pharmacopœia, *pharmacopœia, æ,* f.
Phenacetin, *phenacetinum, i,* n.
Phenazone, *phenazonum, i,* n.; *antipyrinum, i,* n. (U.S.P.).
Phenol, *phenol, olis,* n. (*Cf.* page 307.)
Phenyl, *phenylis, is,* n. (*Cf.* page 307.)
Phial, *phiala, æ,* f.
Phosphate, *phosphas, atis,* m.
Phosphite, *phosphis, itis,* m.
Phosphorated, *phosphoratus, a, um.*
Phosphoric, *phosphoricus, a, um.*
Phosphorus, *phosphorus, i,* m.
Physostigmine, *physostigmina, æ,* f.
Picric, *picricus, a, um.*
Picrotoxin, *picrotoxinum, i,* n.
Piece, a small, *frustillum, i,* n.
  a lump of sugar, *sacchari frustillum.*
Pig, *sus, suis,* m. and f.; *porcus, i,* m.
Pigment, *pigmentum, i,* n.
Pill, *pilula, æ,* f.
Pill-box, *pyxis, idis,* f.
Pilocarpine, *pilocarpina, æ,* f.
Pimento, *pimenta, æ,* f.
Pimple, *papula, æ,* f.
Pine, *pinus, i,* f.
Pinkroot, *spigelia, æ,* f.
Pint, *octarius, ii,* m.
Piperazine, *piperazina, æ,* f.
Piperine, *piperina, æ,* f.
Pitch, *pix, picis,* f.
Pith, *medulla, æ,* f.
Place, to, *pono, posui, positum, ponĕre.*
Place upon, to, *impono, posui, positum, ponĕre.*

Plaster, *emplastrum, i*, n.
Plaster-skin, *aluta, æ*, f.
Plastic, *ductilis*, c.
Platinum, *platinum, i*, n.
Plum, *prunum, i*, n.
Podophyllin, *podophyllinum, i*, n.
Podophyllum, *podophyllum, i*, n.
Poison, *venenum, i*, n.; *virus, i*, n.; *toxicum, i*, n.
Poke-root, *phytolacca, æ*, f.
Pomegranate, *granatum, i*, n.
Poppy, *papaver, eris*, n.
Porcelain (adj.), *porcellanicus, a, um*.
  porcelain dish, *patina porcellanica*.
Portion, *portio, onis*, f.
Pot, a, *olla, æ*, f.
Potash, *potassa, æ*, f.
Potassium, *potassium, ii*, n.
Poultice, *cataplasma, atis*, n.
  a linseed poultice, *cataplasma lini*.
Pound (weight), *libra, æ*, f.
Pour on, to, *infundo, fudi, fusum, fundĕre*.
  to drop into, *instillo, avi, atum, are*.
Powder, a, *pulvis, eris*, m.; *charta, æ*, f., or *chartula, æ*, f., is also applied to small powders dispensed in paper.
Powder, to, *contero, trivi, tritum, terĕre; pulvero, avi, atum, are*.
Precipitate, *præcipitatum, i*, n.
Precipitate, to, *præcipito, avi, atum, are*.
Precipitated, *præcipitatus, a, um*.
Preparation, *præparatio, onis*, f.
Prepare, to, *paro, avi, atum, are; præparo, avi, atum, are*.
Prepared, *paratus, a, um; præparatus, a, um*.
Prescribe, to, *præscribo, scripsi, scriptum, scribĕre*.
Prescription, *præscriptio, onis*, f.
Preserve, to, *condio, ivi (ii), itum, ire*.
Press (squeeze), to, *comprimo, pressi, pressum, primĕre*.
  to press out, *exprimĕre*.
  to oppress, *urgeo, ursi, urgēre*.
  the cough being troublesome, *tussi urgente*.
Prevent, to, *præcaveo, cavi, cautum, cavēre*.
Previously, *prius*.
Prick, to, *pungo, pupugi, punctum, pungĕre*.

Prickly ash, *xanthoxylum, i*, n.
Principal (adj.), *primus, a, um.*
Process, *processus, ūs*, m.
Promptly, *celeriter.*
Proper, *proprius, a, um.*
Prune, *prunum, i*, n.
Pulp, *pulpa, æ*, f.
Pulsatilla, *pulsatilla, æ*, f.
Pulse, the, *pulsus, ūs*, m.
Pulverise, to, *pulvero, avi, atum, are; contero, trivi, tritum, terĕre.*
Pumice, *pumex, icis*, m.
Pungent, *asper, era, erum.*
Pure, *purus, a, um.*
Purgative (adj.), *catharticus, a, um.*
Purge, to, *purgo, avi, atum, are.*
Purge (purging), a, *purgatio, onis*, f.; *catharsis, is*, f.
Purging (adj.), *purgans, antis.*
Purified, *purificatus, a, um.*
Purify, to, *purifico, avi, atum, are.*
Pus, *pus, puris*, m.
Pustule, *pustula, æ*, f.
Put (place), to, *pono, posui, positum, ponĕre.*
Pyroborate, *pyroboras, atis*, m.
Pyrogallic, *pyrogallicus, a, um.*
Pyrogallol, *pyrogallol, olis*, m.

Quality, *qualitas, atis*, f.
Quantity, *quantitas, atis*, f.
Quillaia, *quillaia, æ*, f.
Quinidine, *quinidina, æ*, f.
Quinine, *quinina, æ*, f.

Raisins, *uvæ passæ; passulæ, arum*, f.
Rancid, *rancidus, a, um.*
Rapidly, *rapide.*
Rarely, *raro.*
Raspberry, *rubus idæus*, m.
Raw (uncooked), *incoctus, a, um.*
Real (genuine), *verus, a, um.*
Reason, *ratio, onis*, f.
Receive, to, *recipio, cepi, ceptum, cipĕre.*
Recent, *recens, entis.*
Rectified, *rectificatus, a, um.*
Rectify, to, *rectifico, avi, atum, are.*
Recur, to, *redintegro, avi, atum, are.*
Red, *ruber, bra, brum.*
Red, to make, *rubefacio, feci, factum, facĕre.*
Red currant, *ribes (is) rubrum; ribesium, ii*, n.

Red poppy, *rhœas, rhœados*, f.
Red rose petals, *rosœ Gallicœ petala.*
Redness, *rubor, oris*, m.
Reduce, to, *redigo, egi, actum, igĕre.*
Reduced, *redactus, a, um.*
Refined, *purificatus, a, um.*
Region, *regio, onis*, f.
Reject, to, *rejicio, jeci, jectum, jicĕre.*
Relapse, *recidivum, i*, n.
Relieve, to, *levo, avi, atum, are.*
until the pain is relieved, *donec dolor levatus sit.*
Remain, to, *maneo, si, sum, ēre.*
Remainder, *reliquum, i*, n.; *residuum, i*, n.
Remaining, *reliquus, a, um.*
Remedy, *remedium, ii*, n.; *medicamentum, i*, n.
Remove, to, *eximo, emi, emptum, imĕre.*
Removed, to be, *exulo, avi, atum, are.*
Renew, to. See Recur, Repeat.
Repeat, to, *repeto, ivi (ii), itum, ĕre.*
let the mixture be repeated, *repetatur mistura.*
Repeated, *repetitus, a, um.*
in repeated doses, *dosibus repetitis.*
Repeatedly, *sæpe.*
Residue, *residuum, i*, n.
Resin, *resina, œ*, f.
Resorcin, *resorcinol, olis*, n.
Respiration, *respiratio, onis*, f.
Respond, to, *respondeo, spondi, sponsum, spondēre.*
Rest, *quies, etis*, f.; *tranquillitas, atis*, f.
Restless, *inquies, etis*, f.
Return, to, *redeo, redii, reditum, redire.*
Rhatany, *krameria, œ*, f.
Rhizome, *rhizoma, atis*, n.
Rhubarb, *rheum, i*, n.
Rhus, *rhus, rhoïs*, f.
Rice, *oryza, œ*, f.
Right (side, etc.), *dexter, a, um.*
Rind, *cortex, icis*, m. and f.
Ripe, *maturus, a, um.*
Rod, *virga, œ*, f.
glass rod, *virga vitrea.*
Roll in, to, *involvo, volvi, volutum, volvĕre.*
Rose, *rosa, œ*, f.
Rosemary, *rosmarinus, i*, m.
Rosin, *resina, œ*, f.
Rough, *asper, a, um.*
Round, *rotundus, a, um.*

Rub, to, *frico, cui, ctum* (*catum*), *care.*
  to rub in, *infricare.*
Rubber, *elastica, æ,* f.
Rue, *ruta, æ,* f.
Rum, *spiritus sacchari.*
Rye, *secale, is,* n.

Sabal, *sabal,* n. indeclin.
Saccharated, *saccharatus, a, um.*
Saccharin, *glusidum, i,* n.; *saccharinum, i,* n.
Saffron, *crocus, i,* m.
Safrol, *safrolum, i,* n.
Sage (botan.), *salvia, æ,* f.
Salicin, *salicinum, i,* n.
Salicylate, *salicylas, atis,* m.
Salicylic, *salicylicus, a, um.*
Salol, *salolum, i,* n.; *phenylis salicylas.*
Salt (subs.), *sal, salis,* m.
Salt (adj.), *salsus, a, um.*
Sand, *arena, æ,* f.
Sandal (botan.), *santalum, i,* n.
Santonin, *santoninum, i,* n.
Sarsaparilla, *sarza, æ,* f.; *sarsaparilla, æ,* f.
Sassafras, *sassafras,* n. indeclin.
Saturate, to, *saturo, avi, atum, are.*
Saturated, *saturatus, a, um.*
Savin, *sabina, æ,* f.
Say, to, *dico, dixi, dictum, dicĕre.*
Scammony (plant), *scammonia, æ,* f.
  (gum resin), *scammonium, ii,* n.
Scent, *odor, oris,* m.
Scopola, *scopola, æ,* f.
Scopolamine, *scopolamina, æ,* f.; *hyoscina, æ,* f. (B.P.).
Scrape, to, *rado, rasi, rasum, radĕre.*
Scruple (weight), *scrupulus, i,* m.
Seal, to, *signo, avi, atum, are.*
Sealing-wax, *cera sigillata.*
Sedative, *sedativus, a, um.*
Sediment, *fæx, fæcis,* f.
Seed, *semen, inis,* n.
Selected, *electus, a, um.*
Send, to, *mitto, misi, missum, mittere.*
Senega, *senega, æ,* f.
Senna, *senna, æ,* f.
Separate, to, *separo, avi, atum, are.*
Separate (adj.), *separatus, a, um.*
Separately, *separatim, viritim.*
Serpentary, *serpentaria, æ,* f.
Serum, *serum, i,* n.
Serve, to, *servio, ivi* (*ii*), *itum, ire.*

Serviceable, *utilis, e.*
Sesame, *sesamum, i*, n.
Severe, *severus, a, um; urgens, entis.*
Shake, to, *agito, avi, atum, are.*
shake the bottle, *agita phialam.*
Shape, *forma, æ*, f.
a plaster of this shape, *emplastrum hujus formæ.*
Share, to, *partior, partitus sum, partiri.*
Sherry, *vinum xericum.*
Shredded, *rasus, a, um.*
Sick (adj.), *æger, ra, rum.*
Side, *latus, eris*, n.
Sides, on both (adv.), *utrinque.*
Sieve, *cribrum, i*, n.
pass through a sieve, *trajice per cribrum.*
Sift, to, *cribro, avi, atum, are.*
Sign (label), to, *signo, avi, atum, are.*
Silk (subs.), *sericum, i*, n.
oiled silk, *sericum oleatum.*
Silk (adj.), *sericus, a, um.*
Silver, *argentum, i*, n.
silver leaf, *argenti folium.*
Similar, *similis, e.*
Simple, *simplex, icis.*
Single, *singulus, a, um.*
Size, *magnitudo, inis*, f.
Skill, *ars, artis*, f.
Skullcap (botan.), *scutellaria, æ*, f.
Sleep, *somnus, i*, m.; *quies, etis*, f.
Sleeplessness, *insomnia, æ*, f.
Slice, to, *concido, cidi, cisum, cidĕre.*
Slipper-bath, *semicupium, ii*, n.
Slippery elm, *ulmus, i*, f.
Slow, *lentus, a, um.*
Slowly, *lente.*
Small, *parvus, a, um.*
Smell, a, *odor, oris*, m.
Smoke, *fumus, i*, m.
Smoke, to, *fumo*, no perf. or sup., *fumare.*
Smooth, *lēvis, e.*
Smooth, to make, *levo, avi, atum, are.*
Sneezing, *sternutatio, onis*, f.; *sternutamentum, i*, n.
Snuff (to produce sneezing), *errhinum, i*, n.
Soap, *sapo, onis*, m.
Soapy, *saponarius, a, um.*
Socotrine, *Socotrinus, a, um.*
Soda, *soda, æ*, f.
Sodium, *sodium, ii*, n.
Soft, *mollis, e.*
Soften, to, *mollio, ivi (ii), itum, ire.*

Softness, *mollities, ei*, f.
Sole of the foot, *planta pedis.*
Solid, *solidus, a, um.*
Soluble, *solubilis, e.*
Solution, a, *solutio, onis*, f.
Sorrel, *rumex, icis*, f.
Soup, *jus, juris*, n.
Sourness. See Acidity.
Sparteine, *sparteina, æ*, f.
Spasm, *spasmus, i*, m.; *spasma, atis*, n.
Spearmint, *mentha viridis; mentha sativa.*
Spermaceti, *cetaceum, ei*, n.
Spigelia, *spigelia, æ*, f.
Spine, *spina, æ*, f.
Spirit, *spiritus, ūs*, m.
Sponge, *spongia, æ*, f.
a small sponge, *spongiola, æ*, f.
Spongy, *spongiosus, a, um.*
Spoon, *cochleare* (*cochlear*), *is*, n. (*cf.* page 18).
Spot (mark), *macula, æ*, f.
Spotted, *maculatus, a, um.*
Spray (cloud), *nebula, æ*, f.
Spread (a plaster), to, *extendo, di, sum* (*tum*), *dĕre.*
spread on soft leather, *extende super alutam.*
Spring (adj.), *fontanus, a, um.*
Sprinkle, to, *spargo, sparsi, sparsum, spargĕre.*
Squeeze out, to, *exprimo, pressi, pressum, primĕre.*
Squeeze together, to, *comprimo, pressi, pressum, primĕre.*
Squill, *scilla, æ*, f.
Indian squill, *urginea, æ*, f.
Squirting cucumber, *ecballium, ii*, n.
Stand, to, *sto, steti, statum, stare.*
to let stand, *reponĕre.*
Starch, *amylum, i*, n.
State (condition), *status, ūs*, m.
Stavesacre, *staphisagria, æ*, f.
Steam, *vapor, oris*, m.
Stearic, *stearicus, a, um.*
Sterile, *sterilis, e.*
Sterilised, *sterilisatus, a, um.*
Stiff, *rigidus, a, um.*
Stimulate, to, *stimulo, avi, atum, are.*
Stimulating, *stimulans, antis.*
Stir (a liquid), to, *agito, avi, atum, are.*
Stomach, *stomachus, i*, m., *ventriculus, i*, m.
on an empty stomach, *stomacho* (*ventriculo*) *vacuo* vel *jejuno.*

Stopper, *epistomium, ii,* n.; *obturamentum, i,* n.
glass stopper, *epistomium vitreum.*
Stoppered, *obturatus, a, um; epistomatis, e.*
Storax, *styrax, acis,* m.
Strain (a liquid), to, *colo, avi, atum, are.*
Strained, *colatus, a, um.*
Stramonium, *stramonium, ii,* n.
Strong, *fortis, e.*
Strontium, *strontium, ii,* n.
Strophanthus, *strophanthus, i,* m.
Strophanthin, *strophanthinum, i,* n.
Strychnine, *strychnina, æ,* f.
Stupor, *stupor, oris,* m.
Styptic, *stypticus, a, um.*
Subacetate, *subacetas, atis,* m.
Subchloride, *subchloridum, i,* n.
Subcutaneous, *hypodermicus, a, um.*
Sublimed, *sublimatus, a, um.*
Subnitrate, *subnitras, atis,* m.
Subside, to, *subsido, sedi, sessum, sidĕre.*
Substitute, to, *substituo, stitui, stitutum, stituĕre.*
Suck, to, *sugo, suxi, suctum, sugĕre.*
let a lozenge be sucked every hour, *sugatur trochiscus quaque hora.*
Suet, *sevum, i,* n.
Suffer pain, to, *doleo, ui, itum, ēre.*
Suffice, to, *sufficio, feci, fectum ficĕre.*
Sugar, *saccharum, i,* n.
Sugared, *saccharatus, a, um.*
Suitable, *idoneus, a, um.*
Sulphate, *sulphas, atis,* m.
Sulphide, *sulphidum, i,* n.
Sulphite, *sulphis, itis,* m.
Sulphocarbolate, *sulphocarbolas, atis,* m.
Sulphonal, *sulphonal,* n. indeclin.; *sulphonmethanum, i,* n. (U.S.P.).
Sulphur, *sulphur, is,* n.
Sulphurated, *sulphuratus, a, um.*
Sulphuric, *sulphuricus, a, um.*
Sulphurous, *sulphurosus, a, um.*
Sumbul, *sumbul,* n. indeclin.
Supernatant, *supernatans, antis.*
Supper, *cena, æ,* f.
Support, to, *sustineo, tinui, tentum, tinēre.*

Suppository, *suppositorium, ii*, n.
Surface, *superficies, ei*, f.
Surgical, *chirurgicus, a, um.*
Swallow down, to, *deglutio*, no perf. or sup., *ire.*
Sweat, *sudor, oris*, m.
to cause sweating, *sudorem movere.*
Sweat, to, *sudo, avi, atum, are.*
Sweet, *dulcis, e.*
Sweetness, *dulcedo, inis*, f.
Swell, to, *tumeo, ui*, no sup., *ēre.*
Swelling, *tumor, oris*, m.
Swollen, *turgidus, a, um.*
Symptom, *symptoma, atis*, n.
Syringe, *sipho, onis*, m.
to syringe, *cum siphone lavare.*
Syrup, *syrupus, i*, m.

Tablespoonful, *cochleare (cochlear) amplum*, vel *largum*, vel *magnum.*
Tablet, *tabella, æ*, f.
Take, to, *capio, cepi, captum, capĕre; sumo, sumpsi, sumptum, sumĕre.*
Talc, *talcum, i*, n.
Tamarind, *tamarindus, i*, f.
Tannic, *tannicus, a, um.*
Tannin, *tanninum, i*, n.
Tannin, freed from, *detannatus, a, um.*
Tar, *pix, picis*, f.
Taraxacum, *taraxacum, i*, n.
Tartarated, *tartaratus, a, um.*
Tartaric, *tartaricus, a, um.*
Tartrate, *tartras, atis*, m.
Taste, *gustus, ūs*, m.
Taste, to, *gusto, avi, atum, are.*
Tea, *thea, æ*, f.
Teacupful, *theæ poculum, i*, n.
Teaspoonful, *cochleare minimum*, vel *parvum*, vel *parvulum.*
Temperature, *temperatura, æ*, f.
Temples (anat.), *tempora, um*, n. plur.
Tenacious, *tenax, acis.*
Tender, *tener, era, erum.*
Tepid, *tepidus, a, um.*
Terebene, *terebenum, i*, n.
Terpin, *terpinum, i*, n.
Thebaine, *thebaina, æ*, f.
Theine, *caffeina, æ*, f.
Theobroma, *theobroma, atis*, n.
Theobromine, *theobromina, æ*, f.
Thermometer, *thermometrum, i*, n.
Thick (dense), *spissus, a, um.*

Thicken, to, *spisso, avi, atum, are; densco (denso), ui, itum, ēre.*
Thickness (density), *spissitudo, inis,* f.
Thin, *tenuis, e.*
Thiol, *thiol, olis,* n.
Thirst, *sitis, is,* f.
Thorax, *thorax, acis,* m.
Thoroughly, *omnino.*
Thoroughwort, *eupatorium, ii,* n.
Thread, *filum, i,* n.
Throat, *guttur, uris,* n.; *jugulum, i,* n. [*fauces, ium,* f. plur.; *pharynx, yngis,* m., etc.].
throat-brush, *penicillum pro gutture,* etc.
Throw, to, *jacio, jeci, jactum, jacĕre.*
Thumb, *pollex, icis,* m.
Thyme, *thymum, i,* n.
Thymol, *thymol, olis,* n.
Thyroid (subs.), *thyroideum, ei,* n.
Thyroid (adj.), *thyroideus, a, um.*
Time, *tempus, oris,* n.
at the time indicated, *hora præscripta.*
Times, *vices,* f. plur. defect.
three times successively, *ad tres vices.*
Tin, *stannum, i,* n.
Tincture, *tinctura, æ,* f.
Tingling, *formicatio, onis,* f.
Tissue, *tela, æ,* f.
antiseptic tissue, *tela antiseptica.*
Toasted, *tostus, a, um.*
roasted coffee, *coffea tosta.*
Tobacco, *tabacum, i,* n.
Toe, *digitus pedis.*
Together (at the same time), *simul.*
Together with (adv.), *una.*
Tolu, of, *tolutanus, a, um.*
Tongue, *lingua, æ,* f.
Tonsils, *tonsillæ, arum,* f. plur.
Tooth, *dens, dentis,* m.
Tooth-powder, *dentifricium, ii,* n.
Top, *cacumen, inis,* n.; *vertex, icis,* m.
broom tops, *scoparii cacumina.*
Total, *totus, a, um.*
Touch, to, *tango, tetigi, tactum, tangĕre.*
Tough, *durus, a, um.*
Toughened, *induratus, a, um.*
Tragacanth, *tragacantha, æ,* f.
Transparent, *pellucidus, a, um.*
Treacle, *theriaca, æ,* f.
Trichloracetic, *trichloraceticus, a, um.*

Trinitrin, *trinitrinum, i,* n. (a synonym for nitroglycerin).
Trional, *sulphonethylmethanum, i,* n. (U.S.P.).
Triturate, a, *trituratio, onis,* f.
Triturate, to, *tero, trivi, tritum, terĕre.*
Troublesome, *molestus, a, um.*
True (genuine), *verus, a, um.*
Tube, *tubus, i,* m.; *tubulus, i,* m.
glass tube, *tubus vitreus.*
Tumbler, *cyathus magnus.*
small tumbler, *cyathus medius.*
Turmeric, *curcuma, æ,* f.
Turpentine, *terebinthina, æ,* f.
Turpeth, *turpethum, i,* n.

Ulcer, *ulcus, eris,* n.
Ulcerated, *ulceratus, a, um.*
Ulceration, *ulceratio, onis,* f.
Uncovered (open), *apertus, a, um.*
Undisturbed, *quietus, a, um.*
Uneasiness, *inquietudo, inis,* f.
Unhealthy, *invalidus, a, um.*
Uniform, *æquabilis, e.*
Until, *donec.*
Uranium, *uranium, ii,* n.
Urethral, *urethralis, e.*
Urgent, *urgens, entis.*
Urine, *urina, æ,* f.
Use, *usus, ūs,* m.
for external use, *ad usum externum; pro usu externo.*
Use, to, *utor, usus sum, uti* (governs abl.). *Cf.* Apply.
Useless, *inutilis, e.*
Usual, *solitus, a, um.*
in the usual manner, *more solito.*
Utensil (a vessel), *vas, vasis,* n.

Valerate (valerianate), *valeras, atis,* m. (U.S.P.).
Valerian, *valeriana, æ,* f.
Indian valerian, *valeriana Indica.*
Valerianate, *valerianas, atis,* m.
Valerianic, *valerianicus, a, um.*
Vanilla, *vanilla, æ,* f.
Vanillin, *vanillinum, i,* n.
Vapour (for inhalation), *vapor, oris,* m.
Vapour-bath, *vaporarium, ii,* n.
Variable, *mutabilis, e.*
Variety, *varietas, atis,* f.

Various, *varius, a, um.*
Varnish, *vernix, icis,* f.
'varnished pills' is sometimes rendered *pilulæ tunicatæ.*
Vaseline, *paraffinum molle; petrolatum, i,* n.; *vaselinum, i,* n.
Vehicle, *vehiculum, i,* n.
in a suitable vehicle, *ex vehiculo idoneo.*
Vein, *vena, æ,* f.
Veratrine, *veratrina, æ,* f.
Vessel, *vas, vasis* (gen. plur. *vasorum*), n.
covered vessel, *vas opertum.*
earthenware vessel, *vas fictile.*
Veterinary, *veterinarius, a, um.*
Viburnum, *viburnum, i,* n.
Vinegar, *acetum, i,* n.
Violent, *vehemens, entis.*
Violently, *vehementer.*
Virginian, *Virginianus, a, um.*
Virus, *virus, i,* n.
Viscid, *viscidus, a, um.*
Volatile, *volatilis, e.*
Vomit, to, *vomo, ui, itum, ĕre.*
Vomiting, *vomitus, ūs,* m.

Wahoo, *euonymus, i,* m.
Walnut, *juglans, andis,* f.
Warm, *calidus, a, um.*
slightly warm, *tepidus, a, um.*
Warm, to make, *calefacio, feci, factum, facĕre.*
Warn, to, *admoneo, ui. itum, ēre.*
Wart, *verruca, æ,* f.
Wash, a, *lotio, onis,* f.
a mouth wash, *collutorium, ii,* n.
an eye lotion, *collyrium, ii,* n.
Wash, to, *lavo, lavavi* (*lavi*), *lavatum* (*lautum, lotum*), *lavare* (*lavĕre*).
to wash out, *eluo, lui, lutum, luĕre; colluo, lui, lutum, luĕre.*
Water, *aqua, æ,* f.
Watery, *aquosus, a, um.*
Wax, *cera, æ,* f.
sealing wax, *cera sigillata.*
Weak (feeble), *debilis, e.*
Weakness, *debilitas, atis,* f.; *infirmitas, atis,* f.
Week, *hebdomas, adis,* f.
Weigh, to, *pendo, pependi. pensum, pendĕre.*
Weighing, *pendens, entis.*
Weight, *pondus, eris,* n.
Wet, *humidus, a, um.*
Wet, to, *madefacio, feci, factum. facĕre.*

Wet, to become, *humesco*, no perf. or sup., *ĕre*.
Wetted, *madefactus*, *a*, *um*.
Wheat, *triticum*, *i*, n.
Whey of milk, *serum lactis*.
Whisky, *spiritus frumenti*.
White, *albus*, *a*, *um*.
White of egg, *ovi albumen*, *inis*, n.
Whiteness, *albedo*, *inis*, f.
Whole, the, *totum*, *i*, n.
Whole (adj.), *totus*, *a*, *um*.
Wide, *latus*, *a*, *um*.
Width, *latitudo*, *inis*, f.
Willow, *salix*, *icis*, f.
Wine (subs.), *vinum*, *i*, n.
Wine (adj.), *vinosus*, *a*, *um*; *vinarius*, *a*, *um*.
wineglass, *cyathus vinosus* vel *vinarius*.
Wintergreen, *gaultheria*, *æ*, f.
Wipe, to, *tergeo*, *tersi*, *tersum*, *tergēre* (*tergĕre*).
Wish (be willing), to, *volo*, *volui*, *velle*.
as much as you wish, *quantum volueris*.
Witch-hazel, *hamamelis*, *idis*, f.
Withdraw, to, *removeo*, *movi*, *motum*, *movēre*.
Wood, *lignum*, *i*, n.
Wooden, *ligneus*, *a*, *um*.
Wool, *lana*, *æ*, f.
wool-fat, *adeps lanæ*.
Woollen, *laneus*, *a*, *um*.
Worm, *vermis*, *is*, m.
remedies for worms, *anthelmintica*, *orum*, n. plur.
Wormseed, *santonica*, *æ*, f.
American wormseed, *chenopodium*, *ii*, n.
Wormwood, *absinthium*, *ii*, n.
Wound, *vulnus*, *eris*, n.
Wounded, *saucius*, *a*, *um*.
Wrist, *carpus*, *i*, m.

Year, *annus*, *i*, m.
— years old, *annos — natus*.
Yeast, *fermentum*, *i*, n.
beer yeast, *cerevisiæ fermentum*.
Yellow, *flavus*, *a*, *um*.
Yerba Santa, *eriodictyon*, *i*, n.
Yew, *taxus*, *i*, f.
Yolk (of egg), *vitellus*, *i*, m.; *vitellum*, *i*, n., has been used.
Young, *juvenis*.
young child, *infans*, *antis*, m. and f.
Youth, *juvenis*, *is*, m. and f.

Zinc, *zincum*, *i*, n.

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1 ʒ oil + 2 ʒ Gum acacia
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3 ℈ = 1 ʒ

8 ʒ = 1 ℥

℞ = 57

One pill
Liniments
Emulsion
Powder
} wrapping, &c